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UNIVERSITAT POLITÈCNICA DE VALÈNCIA

FACULTY OF BUSINESS ADMINISTRATION AND MANAGEMENT

MASTER'S DEGREE IN BUSINESS, PRODUCT AND SERVICE MANAGEMENT

EVALUATION OF THE IMPACT OF CONVERTING NON-VALUED FRUITS AND
VEGETABLES INTO RAW MATERIALS AND POWDERED INGREDIENTS AND
REINSERT THEM INTO THE FOOD CHAIN

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Thank you, and thank you all.

Executive Summary

Roughly one - third of the edible parts of food produced for human consumption, gets lost or wasted globally, which is about 1.3 billion ton per year (FAO. 2011. Global food losses and food waste – Extent, causes and prevention. Rome).

There will be nearly 10 billion people on Earth by 2050 – approximately 3 billion more people, at all ages, to feed than there were in 2010 (Ranganathan, J., Waite, R., Searchinger, T., & Hanson, C., 2018). Due to population growth in the next 30 years, there will be shortage between the amounts of food is currently being produced nowadays and the quantity needed to feed everyone in the globe. Productive fields won't have the capacity and, in order to be sustainable, reduction of food loss and waste are definitely a top priority actions recommended by The World Resources Institute (WRI).

Currently there are sustainable initiatives to mitigate the waste problem. Companies have started operations to transform non-valued products into fortified ingredients to process and creates final products. As well as initiatives to transform mango waste into leather sheets for the production of belts, purses and wallets.

The importance of using Circular Economy and environmentally friendly models, such as: Resource Recovery – in order to reduce Green House Gasses Emissions, enhance the economy, implement the philosophy of waste as value, generate indirect and direct jobs for unemployed and social exclusive people, and minimize the environmental impact generated by products that will not be consumed.

As better income, new trends and believes rise, people will increasingly consume more, re-use non valued foods and will be more conscious about animal-based foods.

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LIST OF ABBREVIATIONS

CO₂: Carbon Dioxide

HORECA: Hotels, Restaurants and Catering

SDG: Sustainable Development Goals

CE: Circular Economy

FSC: Food Supply Chain

FAO: Food and Agriculture Organization

WRI: World Resources Institute

GHG: Greenhouse gas

EPA: United States Environmental Protection Agency

EU: European Union

MAPA: Ministry of Agriculture, Fishing and Food

EPA: Encuesta de Población Activa – Labor force Survey

INE: National Institute of Statistics

UN: United Nations

CAGR: Compound annual growth rate

1 INTRODUCTION

While many waste food in the world, there is hunger, malnutrition and poverty. Only knowledge, innovation and a globally strategically aim could support to overcome and improve those aspects that are threatening our society and the world's food security.

Food losses represent a waste of land, water and energy; these natural resources used in production are generally taken for granted. Particularly in the poorest and not productive countries, food losses have an impact on their economic development, on their environment and on food quality and safety. Prepared food creates CO₂ emissions, not consuming it represent waste of resources and environmental damage.

Through the Food Supply Chain there are causes that end up in food losses, and these is different form one country to another and it does depends mainly on the precise resources and technology of a particular country. So does the food consumption trends. In general terms, loss of food or waste will be subject to different variables, such as: Weather (regular, too hot or cold), ability of choosing the right crops for its production, national patterns, internal infrastructure and the capacity to bring foreign direct investment, economic development and the priority of local governments to explore new fields, capacity and knowledge, adequate food supply chain and proper distribution channels, consumer purchasing knowledge and food good use practices.

Farmers and consumers have a direct and negative economic impact while losing food. There is plenty of people living on the margins of food insecurity; a reduction in food losses could have an immediate and significant impact on their livelihoods. For those consumers, the priority is clearly to have access to food products that are nutritious, safe and affordable. In the world some starve to dead, while others waste.

Improving the efficiency of converting non-valued fruits and vegetables into raw material and powdered ingredients and reinsert them into the food chain as final products could support the Sustainable Development Goal (SDG) 12, responsible consumption and production; To ensure sustainable consumption and production patterns, and try to make this world, a little bit better.

The aim of this study is to analyze the fruit and vegetable production and suggest within the industry the implementation of a Circular Economy based on Resource Recovery Business Model for farmers and producers willing to explore different approaches to convert waste into value and identify - validate - the viability of converting non - valued into final products, having the cause and effect Ishikawa Fish bone model as methodology to identify the root cause and supported by specific R&D + i producer's interviews and end user food trend consumptions surveys (Case Study).

The evaluation of the impact would be described socially, economically and environmentally while approaching the SDG 1, No poverty; to end poverty in all its forms, everywhere, and the SDG 2, zero hunger; end hunger, achieve food security and improved nutrition and promote sustainable agriculture.

1.1 Motivation

Including me, there is a lot of people who have not gone through hunger and extreme poverty, yet we take those precious aspects for granted. Therefore, and to feel helpful with the cause, I was keen to investigate, analyze and proposed different approaches within a same strategy that could sake the improvement of responsible production and consumption, zero hunger and end – somehow – poverty.

I loudly celebrate the companies that have had the idea and the resources to transform non-valued food and reinsert them into the food chain, as I believe their business widely support the strategically aim of make this world, a little bit better.

Furthermore, I was curious about the viability and the possible methods to reduce waste while harvesting, by recollecting powerful information and by developing a Cause and Effect, Ishikawa Fish Bone Model (Ishikawa k, 60s) and going through a Case Study that could be linkable and also as a support to the implementation of a circular economy based on Resource Recovery business model.

The knowledge acquire trough the master degree at the UPV has supported the development of this project. Applying the different research techniques and the methodology and models learnt through the course.

Figure 1. Food loss and food waste



Source: FAO Org Food loss and food waste,2020

1.2 Aim and Objectives

In general terms, this Master's Final Project focuses to contribute with a detail investigation within the field of resource recovery, transformation of raw materials to final products, Circular Economy (CE) and sustainable development.

However, the specific aim of this thesis is to evaluate the social, environmental and economic impact of implementing a Resource Recovery Circular Economy Business Model within food producers (Farmers) and becoming more circular through the following objectives:

1. To develop a food waste, cause and effect, Ishikawa Fish bone model that could support the implementation of new techniques to reduce waste.
2. To identify the potential of circular economy on the agroindustry.
3. To develop new key partners within a proposed resource recovery circular economy business model.
4. To evaluate, through interviews (Case Study), and surveys the viability of transforming non-valued fruits and vegetables into raw and powdered ingredients and reinsert them into the Food Supply Chain
5. To approach and link the thesis to the Sustainable Development Goals, especially SDG 1, 2 & 12.

2. FOOD WASTE AND PRODUCTION

Approximately one third of the food produced over the world for human intake is wasted or gets lost due to different factors. This is 1.3 billion ton per year (FAO. 2011. Global food losses and food waste – Extent, causes and prevention. Rome).

Per the report, waste occurs along the Food Supply Chain (FSC), since basic agricultural land production until final client consumption. Due to poor resilience and food consumption auto critic, in countries with greater purchasing power food gets wasted even if it has positive best before consumption label. It is well known that most of the food loss and waste occurs while early stages of the FSC.

On the other hand, countries with fewer purchasing power or low income, there is bigger waste at early phases of the FSC, considering lack of economic and organize resources. Nevertheless, lees food is wasted at the final user level.

2.1 Main concerns

Food waste reduction is widely recognized as an urgent issue. Even though, there is some world cooperation projects that address this issue, time plays against. There is a big preoccupation by activist and worldwide leaders, global food gap is already happening as the world population rapidly grows. Decrease of food loss and waste has been identify as a topmost priority.

On 2050, the world will approximately have 10 billion people, which is 3 billion more mouths to feed and the preoccupation relies on the big shortfall between the amount of food that we are capable now a days to produce and the amount that will be needed to properly feed the new comers. (Ranganathan, J., Waite, R., Searchinger, T., & Hanson, C., 2018).

Higher income, new trends and believes rises around the world, therefore people will begin or increase the intake of sustainable and animal-based foods. At the same time and as part of the main concerns, producing companies urgently need to reduce greenhouse gas (GHG) emissions from agricultural production and do their best to slowly stop changing the few remaining forests to productive agricultural fields.

The Farm - to - Fork journey uses precious resources that result in carbon emissions, considering production and processing, to storage and transportation. If the food is wasted trough this part of the FSC, those affectation to the environment has been unnecessary place on top of the actual problem.

The food industry has to become more consent with the natural recourse having in mind the sustainable challenges the rise fast. Companies to mitigate the above, could begin to approach and move into circular economy with the main idea to reinserted the produce into the food chain. (Aschemann-Witzel, J., & Peschel, A. O., 2019).

2.1.1 Definition of food losses and food waste & Types of food waste

The decrease in edible food for human consumption, including fruits and vegetables, refer specifically to food loss or waste. This could occur throughout different stages of the food supply chain. Food losses normally happened at production, postharvest and processing (Parfitt et al., 2010).

Per definition, Food waste is measured only for products that have been created and focused to human consumption, and therefore, within FSC of vegetable commodities and products, there are specific causes for loss / waste.

Losses due to mechanical damage and/or spillage during harvest process are known as a cause while agricultural production. Post-harvest handling and storage includes losses due to spillage and degradation during handling, storage and transportation between farm (Producer) and distribution. Processing losses during industrial or sometimes artisanal processing, (e.g. jams or juice production, canning (Hearts of Palm)). Losses may occur inside the factory while washing the

product, peeling – slicing it and also when cooking. Waste does also occurs while distributing the products, including throughout the market system and its main players: Wholesale, supermarkets, retailers and organic non-traditional markets. One of the most relevant is waste at consumption, including but not limited to, household and Hotel, Restaurant and Catering (HORECA) level.

2.1.2 Food loss (Supply Chain) - Where do (Continents) food loss and waste occur along the FSC?

Food loss and waste occurs along the food supply chain, from consumption to production, going through distribution and market, processing and handling and storage. Each step is crucial and all of them could improve by switching trends and techniques.

In fact and as a big problem, the most accountable waste in landfills are food and nothing compared to any other kind of unused. When food decomposes or putrefies, it releases methane, a warming gas that the United States Environmental Protection Agency (EPA) strongly mentioned is 25 times more dangerous than carbon dioxide. Said so, food waste and lost produces 8 percent of global greenhouse gas emissions. If food waste were a country, it would be the third-largest greenhouse-gas-emitting country in the world (Malloy C, 2021)

Considering the issues, consumption trends at final level are changing, nowadays in some countries, there are organic and non-traditional markets (off and on line) that sell imperfect foods such as carrots, apples with black spots, unshaped vegetables, or mangoes and avocados with slight imperfect or sunburn. People switching their minds and beginning to purchase fresh with lack of cosmetic perfection are supporting farmers, not only with additional revenue, but also preventing potential waste and climate change.

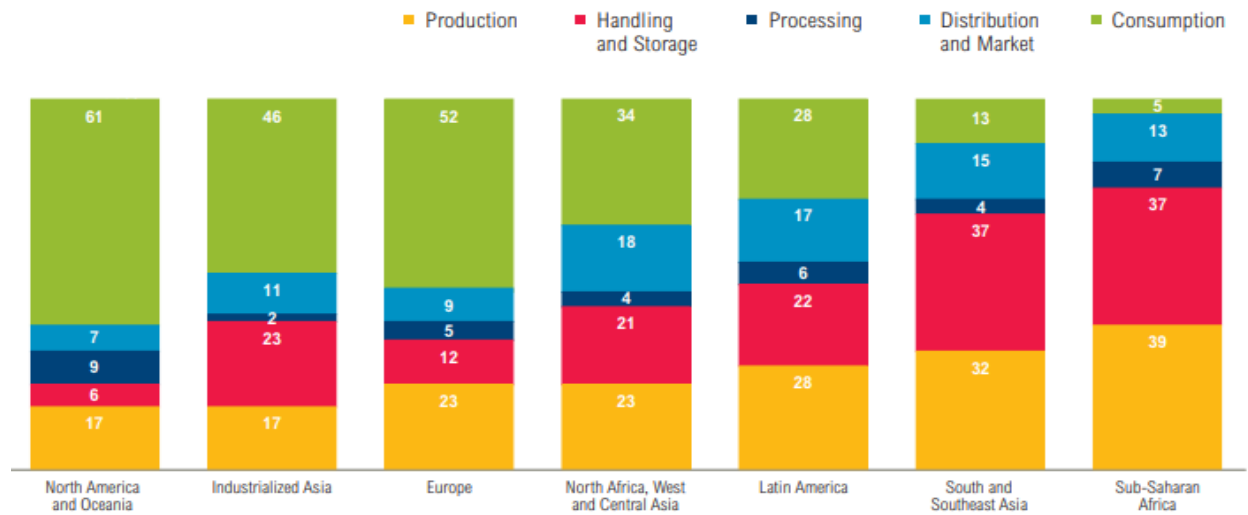
Figure 2 Imperfect Fruits and Vegetables



Source: Imperfect foods, 2021

As per the graphic bellow, the type of waste depends on each continent and its development, not only technological but also appropriate set of mind. The table is marked with colors that represent the percentage of waste while different phases of the FSC.

Figure 3. World Resources trough Supply Chain



Source: World Resources Institute analysis based on FAO, 2011

2.1.3 Worldwide Consumption VS Production & What is being lost and wasted in the world by commodities

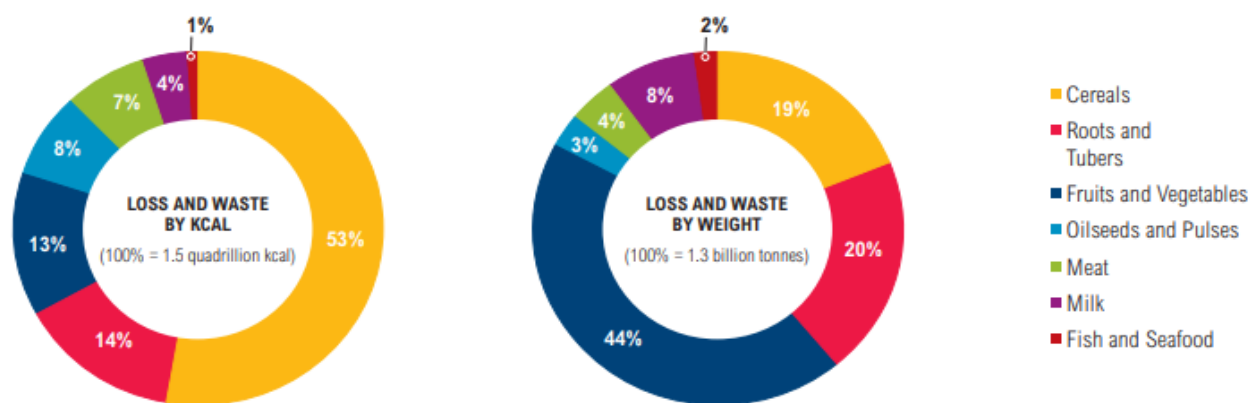
As mentioned at the beginning of chapter 2 and based on the WRI analysis based on FAO 2011; in medium - and high - income countries, such as North America and Oceania (61 %), Industrialized Asia (46 %) and Europe (52 %) the major percentage of Waste occurs while consumption, even if the food still suitable for human intake, after excessive purchase. And the fewer waste has been identified on the production of food, since those countries are well developed and possess strict procedures and outstanding technologies.

On the other hand, countries with fewer purchasing power or nonproductive land, food is mainly lost during the early and middle stages of the FSC, however; much less food is wasted at the consumer level. Production wise, Sub – Saharan Africa waste 39 %, South and South East Asia 32 % and Latin America 28 %, while in consumption, Africa only waste 5 %, South East Asia 13 % and Latin America the same value as production, 28 %. Waste on handling and storage is also relevant in Africa and South East Asia, having both a waste of 37 % (Near to production).

As mentioned before, 1.3 billion tones is the total amount of food loss and waste measured by weight, the graphics bellow measure food in terms of calories and weight, highlighting principal food commodities. Cereals accounts (53 %) being the higher in terms of calories, fruits and vegetables (44 %) are the largest source of waste with regards weight, followed by fish and sea food (20 %) and cereals (19 %).

All this foods provides essential vitamins and minerals for leading a healthy standards of life, waste means people left without this basic and well need intake.

Figure 4. Global food losses and food waste



Source: WRI analysis based on FAO. Global food losses and food waste – extent, causes and preventions. Rome. UN FAO, 2011

2.2 Spanish agroindustry production diagnosis

According to data from the Ministry of Agriculture, Fishing, and Food (MAPA), the value of the Production of the Agricultural Branch (PRA) in 2019 ascended to 50,656.9 million euros.

Spain is one of the producing leaders of fruits and vegetables, is well known as the orchard of Europe. The value of the Spanish production of fruit and vegetables rose to 17,911.9 million euros in 2019 (Alimentation in Spain - MERCASA, 2020). Out of all the Spanish agro food sectors, the one that contributed the most in 2019 were vegetables with 9,624.8 million euros. The vegetable data includes - the small contribution - from the flower and plant sector, according to the data revealed by the Ministry of Agriculture. Furthermore, the fruit subsector contributed 8,287.1 million euros.

As per the table below, the total amount in tons produced by Spain in the main agricultural and livestock sectors in 2019 was 68,894.600 (Millions). The amount produced by Spain on the fruits and vegetables sector, which is 28,211.900 (Millions) or the 42.17 % of the total.

Table 1. Main Agricultural and Livestock Production

PRODUCT	(Thousand - Tons)	PRODUCT	(Thousand - Tons)
Wheat	5,841.0	Potatoes	2,269.0
Barley	9,129.5	Tomato	5,213.0
Corn grain	3,842.5	Green beans	141.3
Rice	808.0	Pepper	1,441.4
Garbanzo beans	47.7	Artichokes	201.6
Dry peas	174.7	Broccoli	541.0
Sunflower oil	788.2	Cauliflowers	187.8
Sugar beet	2,774.0	Garlic	274.6
Watermelon	1,210.7	Onions	1,369.6
Melons	641.5	Zucchini	602.0
Strawberry	352.4	Cucumbers	622.0
Apples	664.2	Lettuce	1,008.5
Pears	314.4	Carrots	368.2
Albaricoques	131.7	Olive oil (campaña 19/20)	1,118.2
Peaches	910.6	Olives dressing (campaña 19/120)	462.0
Banana	396.7	Wine and must (millones de hl.)	37.2
Grapes	331.5	Beef	695.9
Oranges (campaña 19/20)	3,331.3	Sheep meat	116.6
Tangerines (campaña 19/20)	1,815.2	Goat meat	10.2
Lemon (campaña 19/20)	922.9	Porcine meta	4,627.2
Shell almonds	331.8	Bird meat	1,736.1
		Rabbit meat	52.6
		Cow milk	7,222.0
		Sheep milk	509.0
		Goat milk	474.0
		Eggs	833.0
		SUB TOTAL	28,211.900
		(Fruits and Vegetables)	
		TOTAL	66,894.600

Source: Self-Made, main agricultural and livestock production in Spain, Highlighting fruits and vegetables - based on Alimentation in Spain, MERCASA (2020)

2.2.1 Agroindustry Spanish Employment and Spanish Barometer

According to data from the Labor Force Survey (EPA) and diagnosed by the National Institute of Statistics (INE), at the end of 2019 there were a total of 906,925 active people within the primary sector (agriculture, livestock, hunting, forestry and fishing)

In the food and beverage industry the number of employed persons at the end of 2019 (data from the EPA for the fourth quarter) amounted to 462,300 people, 4.2% more than in the same period of the previous year, 2018.

The Spanish barometer designed by the Ministry of Agriculture, Food and Environment of agro-industry (2015) is an official statistic that belongs to the national statistical plan, which has been carried out since 2003, based on interviews with all agents involved in the agro-food sector (Farmers, producers, industries, wholesalers, distributors and consumers). A reliable information

on the agro food sector, such as: wastage and food loss is obtained and presented within the industry through a general report pointing out the most relevant aspects.

The interviews were conducted to Farmers, industry producers, wholesalers and distributors of different sectors, including the most relevant for this thesis, fruits and vegetables, but also to: critics, sea food, wine, cereals, among others.

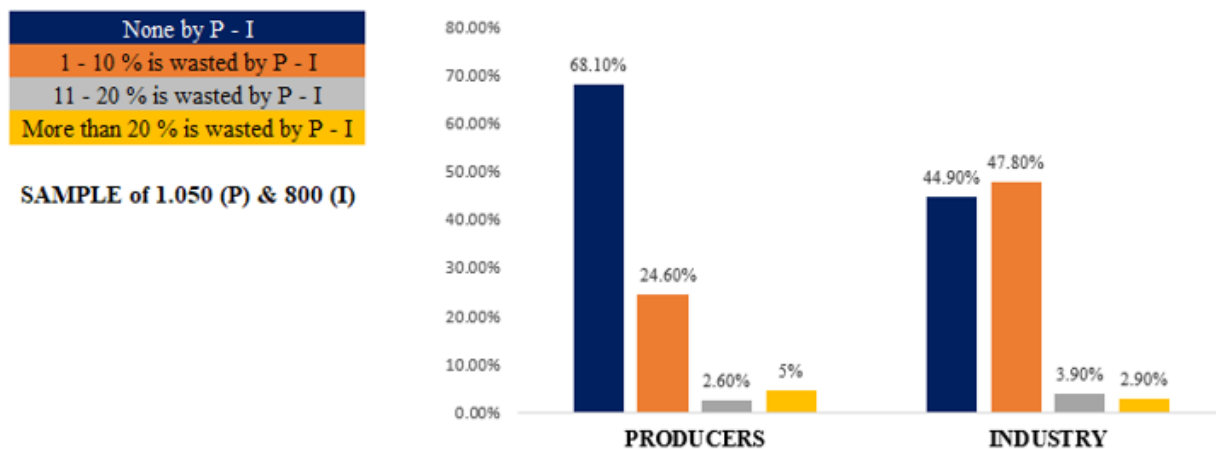
There were 4.200 interviews per term on 2015. 1050 interviews to producers (farmers), 800 to Industry, 150 to wholesalers, 700 to distributors and 1500 to consumers among the autonomic communities of Spain.

2.2.2 Food Wastage in Spain according to producers and the industry (Lack of Commercialization)

An interviewed sample of 1.050 producers (P) and 800 at the industry (I) in 2015, conclude that the wastage, due to lack of commercialization, is as followed:

The subsequent table represents the percentage of wastage of products (all sectors) that cannot be commercialized by producers; being 68.10 % of the producers (interviewed) and 44.90 % of the industry saying that there is no waste, 24.60 % of the producers and the 47.80 % of industry waste between 1 - 10 %, 2.60 % of producers and 3.90 % of the industry admitting that they waste between 11 – 20 %, and the 5 % of producers and 2.90 % of the food industry waste more than 20 %.

Figure 5. Percentage of wastage by producers (P) and industry (I) due to lack of commercialization - Unic responses



Source: Self Made, wastage due to lack of commercialization - based on the Spanish barometer designed by the Ministry of Agriculture, Food and Environment of agro-industry (2015)

2.2.3 Potential causes of Food Wastage in Spain

There is many causes for wastage trough the FSC, however, the most relevant are stated on the table below, which addresses the causes of wastage in 2015 through Spain, the most relevant aspect for producers, industry and wholesalers is that the product have been spoiled. A sample of 334 Farmers stated that 41.9 % of the produce is wasted due to damage, 25.4 % over production, 8.7 % bad crops and 6.9 % they mentioned that the client does not pay, among others causes.

Table 2. Causes of Wastage - Spontaneous and multiple responses

CAUSES	Producers (Farmers)		Industry		Wholesalers	
	2015%	2012%	2015%	2012%	2015%	2012%
Have been spoiled	41.9	43.9	48.2	47.3	78.9	73.9
Over production	25.4	20.9	19.5	20.6		
Bad crops	8.7	8.5				
It is not sold / the client does not pay	6.9	7.2	4.4	6		
Quality control	4.5	6.5	3.4	2.2		
Inadecuate commercial strategies	7.2	6.1	5	5.2	22.1	23.6
Pests	5.7	5.9				
Expiration date	3.9	4.2	4.4	5.2		
Animal dead	4.5	3.6				
Price battle	2.7	2.6	0	0.2		
Unusable waste			2.8	2		
Defective Packaging			26.9	26		
Not sale, has expired					17.9	10.5
Others	3	2.2			14.7	7.4
SAMPLE	334	308	436	407	95	91

Source: Self Made, causes of wastage - based on the Spanish barometer designed by the Ministry of Agriculture, Food and Environment of agro-industry (2015)

2.2.4 What does the Spanish food industry do with Wastage

According to the Spanish barometer, the food industry within Spain has different actions with regards of what they do with the wastage, on the following table we can point out the most relevant. The 51.5 % of producers (farmers) throw way, and 3 % destroyed the wastage, while the 35 % recycle or reuse.

Positively there is an important percentage that does reuse the wastage, however, it is worrying that more are not into sustainable production or reutilization of nonvalue wastage to transform and reinsert into the FSC.

Table 3. What the industry does with wastage - Spontaneous and multiple responses

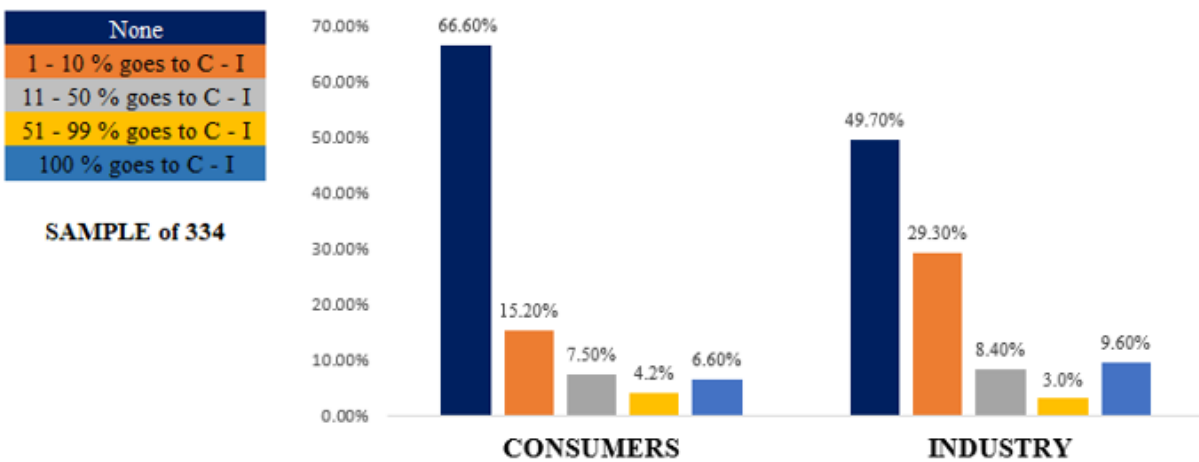
ACTIONS	Producers (Farmers)		Industry		Wholesalers	
	2015%	2012%	2015%	2012%	2015%	2012%
Throw away	51.5	50.6	49.8	53	51.6	50.8
Recycle - Reuse	35	38.6	30	31.4	24.2	22.4
Donated to food banks / NGOs	17.4	9.2	20.9	18	40	44.9
Destroyed / incinerated	3	3.3				3.2
Sold at a lower price	2.7	3	2.1	2.8		
Sells it for animals / feed			5	4.6		
Don't waste / throw away almost nothing			0.9	1.2		
Are returned					1.1	2
Give them to animals					5.3	3.3
Sent for recycling			0.9	2		
Others	3.3	3.6	0.7	0.8	1.1	3.2
SAMPLE	334	308	436	407	95	91

Source: Self Made, actions of wastage - based on the Spanish barometer designed by the Ministry of Agriculture, Food and Environment of agro-industry (2015)

2.2.5 What percentage of non-commercialized food goes to consumers and industry

On the table below and per the barometer, the majority (49.70%) of the sample (334) interviewed through the Spanish barometer, accepted that none (blue) of the non-commercialized food goes to the industry, 28.30% admitted that between 1 – 10 % goes to the industry, 8.40 % mentioned that between 11 – 50 % are delivered to the industry, 3 % between 51 – 99 % and 9.60 % positively stated that its 100 % of non-commercialized food goes to the industry for processing.

Figure 6. What percentage of non-commercialized food goes to consumers (C) and industry (I) - Unic Response.



Source: Self Made, non-commercialized food goes to C and I - based on the Spanish barometer designed by the Ministry of Agriculture, Food and Environment of agro-industry (2015)

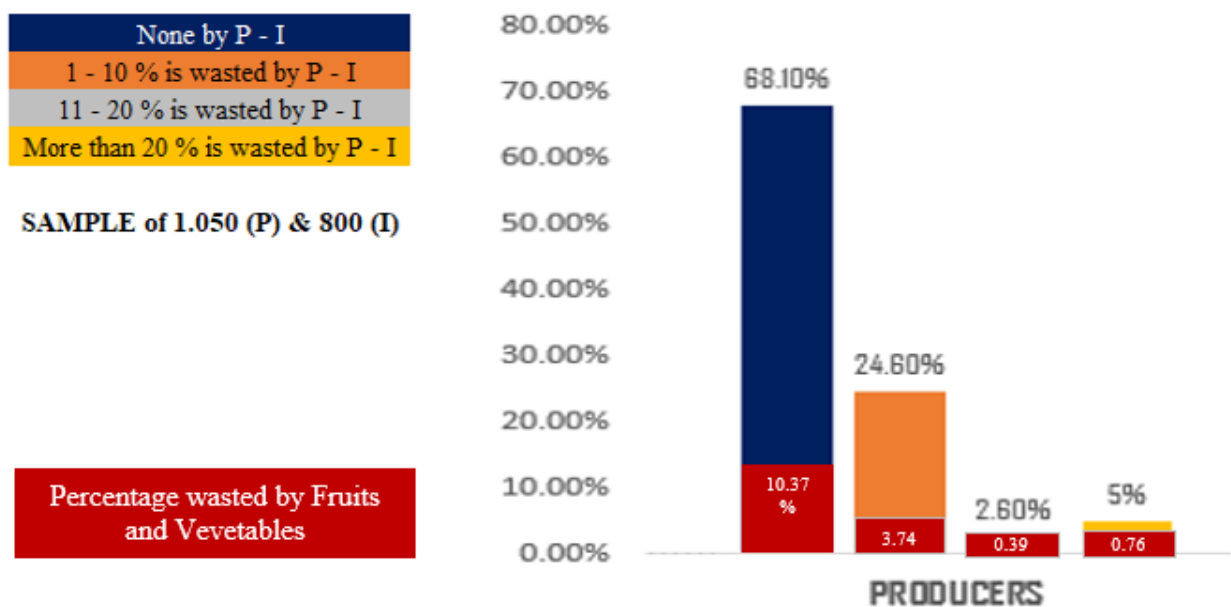
2.2.6 Fruits and vegetables wasted by producers due to lack of commercialization in Spain

Out of the 1.050 producers interviewed of different sectors, such as: Fruits, vegetables, critics, fat and oils, wine, livestock, sea food, aquaculture and cereals; 160 conducted interviews around Spain, including the most productive communities such as: Andalucía, Extremadura, Murcia and Valencia, belongs to Fruits, vegetables and critics, which corresponds the 15,23 % of the total (1.050) producers interviewed.

Therefore, and taking into consideration chapter 2.2.1 - Food Wastage in Spain according to producers (Lack of Commercialization) – the percentage of fruits, vegetables and critics wasted are as follow:

The next table represents the percentage of wastage of Fruits, Vegetables and Critics of the total food wastage in Spain, out of 68.10 % all sectors (interviewed), 10.37 % of producers of Fruits, Vegetables said that there is no waste at all, out 24.60 % of the whole sample, 3.74 % waste between 1 - 10 %, out of 2.60 %, 0.39 % waste between 11 – 20 %, and out of the 5 %, 0.76 % of the producers of fruits, vegetables and critics waste more than 20 %.

Figure 7. Percentage of wastage of fruits and vegetables by producers (P) due to lack of commercialization



Source: Self Made, percentage of wastage due to non-commercialized fruits and vegetables - based on the Spanish barometer designed by the Ministry of Agriculture, Food and Environment of agro-industry (2015)

2.2.7 Spanish agroindustry diagnosis conclusions

The main cause of wastage as per producers (Farmers) in 2015 is that products have been spoiled, there is over production, bad crops and the clients do not pay due to lack of cosmetic perfection or imperfect foods.

51.5 % of producers (farmers) throw away wastage, 3 % destroyed it, while 35 % recycle or reuse. Positively there is an important percentage that does reuse the wastage and try to reinsert it into the FSC, however, it is worrying that more are not into sustainable production.

5 % of producers and 2.90 % of the food industry interviewed admitted that more than 20 % of food production is wasted, therefore, - and having waste as main concern - those agreed that the Government of Spain should be the main responsible to take measures to mitigate the high amount of food waste.

With regards Fruits and vegetables, Spanish producers (farmers) stated that due to lack of commercialization, 3.74 % waste between 1 - 10 %, 0.39 % waste between 11 – 20 %, and 0.76 % of the producers of fruits, vegetables and critics waste more than 20 %. If the median (and the minimum in the last variable) is used and compared to the amount of tons (28 millions) produced in Spain within the fruits and vegetables, the amount of 11 million tons (Aprox) are wasted.

Table 4. Total Spanish production VS Waste - Fruits and Vegetables

Production	% (Interviewed)	Waste between	Median or minimum	Waste in TONS (Millions Aprox)
28,211.90	10.37%	None	None	0
	3.74%	1 - 10 %	5%	1,410.60
	0.39%	10 - 20 %	15%	4,231.79
	0.76%	more than 20 %	20%	5,642.38
TOTAL				11,284.76

Source: Self-Made, total production VS waste, fruits and vegetables - based on the Spanish barometer designed by the Ministry of Agriculture, Food and Environment of agro-industry (2015) and the Spain alimentation MERCASA (2020)

2.3 Sustainable Development Goals (SDG) and the relevance to the topic

The United Nations (UN) and its members adopted the 2030 agenda for Sustainable Development focusing on 17 goals which are known as call for action by all countries - developed and developing - in a global partnership to mitigate urgent facts.

Strategies must go hand by hand to improve and recognize poverty, health, education, inequality while dealing with climate change and working to protect the oceans and remaining forests (Sdg UN Org, 2020).




Considering the importance, 178 countries adopted the 2030 Agenda and have worked to mitigate all the issues that are threatening our society. The research topic and proposed objectives, try to support SDG 12 - Responsible consumption and production – in order to tackle its issues and some

of the problems of SDG 1 - No poverty; End poverty in all its forms everywhere – and SDG 2 - Zero Hunger; End hunger, achieve food security and improved nutrition and sustainable agriculture.

On the following table, there are real shocking facts of what is happening around the globe, the most relevant to the thesis are: Plus 71 million people are pushed into extreme poverty in 2020; 26.4 % of people are affected by food insecurity; the world continues to use natural resources unsustainably - 85.9 billion tons of global material (food print in 2017) and 13.8 % of food is lost in supply chains. Anyhow, those are juts few examples as mind opener to begin worrying about meeting current and future needs and try to change.

It is important to meet and fulfill the needs of the present without compromising the resources and the ability of future generations to succeed by meeting its own needs at that specific period of time. This having in mind a sustainable concept at a system level. (UN, 1987).

Table 5. Sustainable Development Goals - Facts Agenda 2030

SDG No.	Facts
	<p>In 2016, 4 billion people lived with out any social protection In 2020, more than 71 million people will be pushed into extreme poverty (Covid accelerator) Due to natural disasters, there is 23.6 billions of economic losses</p>
	<p>26.4 % of people are affected by food insecurity The crisis hit harder small food producers. Between, 40 - 85 % in developing countries 144 million of children in the world under 5 are stunted 47 million people are affected by wasting</p>
	<p>COVID 19 disruption will impact decades of improvements Lack of attention due to the pandemic will lead to 100 % increase in different illness, such us: Malaria, specially in Sub-Saharan Africa</p>



During the pandemic, 1.6 billion workers on the informal economy risk losing their livelihoods
The world faces the worst economic recession since the great depression in 2020
COVID - 19 could cause the equivalent of 400 job losses (Second quarter 2020)



Only 35 % of small scale industries have access to credit in developing countries (2006 - 2018)
1 in 5 people use the internet in 2019



Lack of aid due to recession for developing countries, from 420 to 271 USD billion (2018)
The pandemic hit harder to: Migrants, refugees, elder, person with disabilities, children and women



Cities need to be more inclusive, safe, resilient and sustainable
Only half the world's urban population has convenient access to public transport (2019)
In 2016, air pollution caused 4.2 million of premature deaths



13.8 % of food is lost during FSC



Only 85 countries have national disaster risk reduction strategies
Climate change (natural disasters) affects more than 39 million people in 2018



CO2 continues to threaten marine environments and ecosystem
Heavy problems due to illegal and unregulated fishing



31,000 species are threatened with extinction. Trafficking of animals cause infectious diseases.
Two billion of hectares of land on earth are degraded, affecting some 3.2 billion people.
Each year 10 million hectares of forest are destroyed (2020) mainly for agricultural expansion



100 civilians are killed everyday in armed conflicts
 60 % of prisons are overcrowding
 79.5 million people in 2019 fled war and persecution

Global foreign direct investment is expected to decline by up to 40 % in 2020.
 Lower purchasing countries will have an economic decline to fall from 554 (2019) to 445 billion (2020)

Source: Self Made, SDG Facts - based on SDG UN ORG, 2021

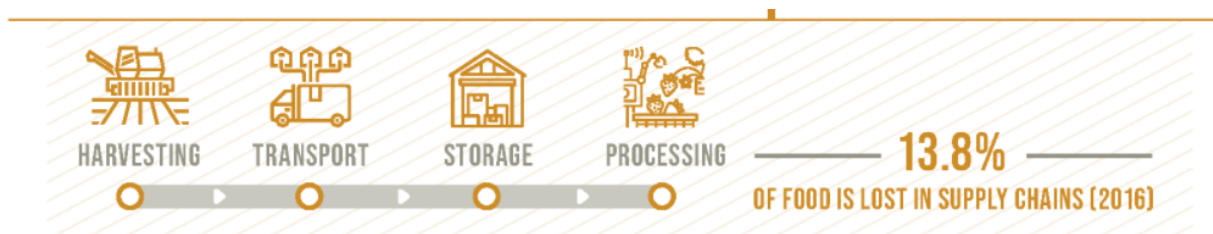
2.3.1 SDG 12 Responsible consumption and production

As mentioned above, the intention of going through the 17 Goals is to understand the challenges that we all are facing and how we can contribute to support this cause. Therefore, this thesis promote responsible consumption and production by suggesting a circular economy business model to provide a different way of reducing food while converting to final products.

As per the UN SDG 12, production and consumption is key factor to the global economy; its impact is measured as a driving force. These days, the inconsequential use of natural resources continue to have a direct negative impact on the environment and the planet. Our future development and survival relies on the economic and social progress, but most important the solutions engage to mitigate de degradation of the environment.

Each year, one third of all food produced – approximately 1.3 billion tones worth around \$1 trillion – ends up rotting in the bins of consumers and retailers, or spoiling due to poor transportation and harvesting practices, which is extremely worrying considering that if the global population reach 9.6 billion by 2050, the equivalent of almost three planets could be required to provide the natural resources needed to sustain current lifestyles.

Figure 8. Lost - Food Supply Chain



Source: UN Org, SDG 12, 2020

The main idea of sustainable consumption and production is to create and do more friendly activities with fewer resources. It is relevant to empower economic growth, increase resource efficiency and promote all over the world sustainable lifestyles with the intention to reduce the 13,8 % of food which is lost within all the phases of the FSC. (UN Org, SDG 12, 2020).

A great part of what is currently lost can be used, approaching new cycles and promoting new developments to minimize waste. This is why, waste prevention through value-adding reuse products in a circular bio-economy can make an enormous role to achieve the SDG 12. Consumer behavior and massive surveys research can support the intention of guiding new consumers into greater circularity in the FSC (Aschemann - Witzel et al., 2019)

Figure 9. Unsustainably use of natural resources



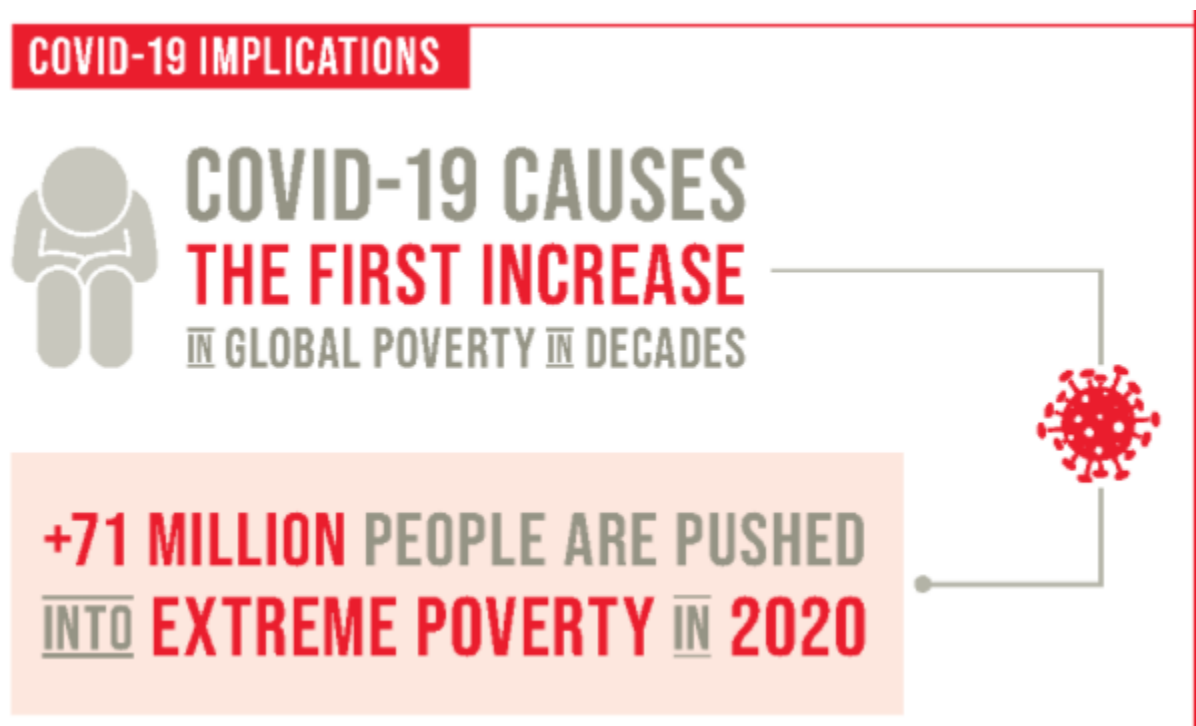
Source: UN Org, SDG 12, 2020

2.3.2 SDG 1 No poverty

This thesis intends to mitigate poverty by proposing a circular business model within the strategy of creating new jobs that, first: support reducing waste, and second: transform non valued into final product; by doing so those new employees could assure decent live. Sustainable consumption and production could also contribute considerably to poverty alleviation.

In many countries, having a job does not guarantee a decent living considering there is formal and informal types of jobs. In fact, 8 per cent of employed workers and their families worldwide lived in extreme poverty in 2018. As matter of fact, one out of five children live in extreme poverty; protect those vulnerable via social protection is very important to reduce poverty. (UN Org, SDG 1, 2020).

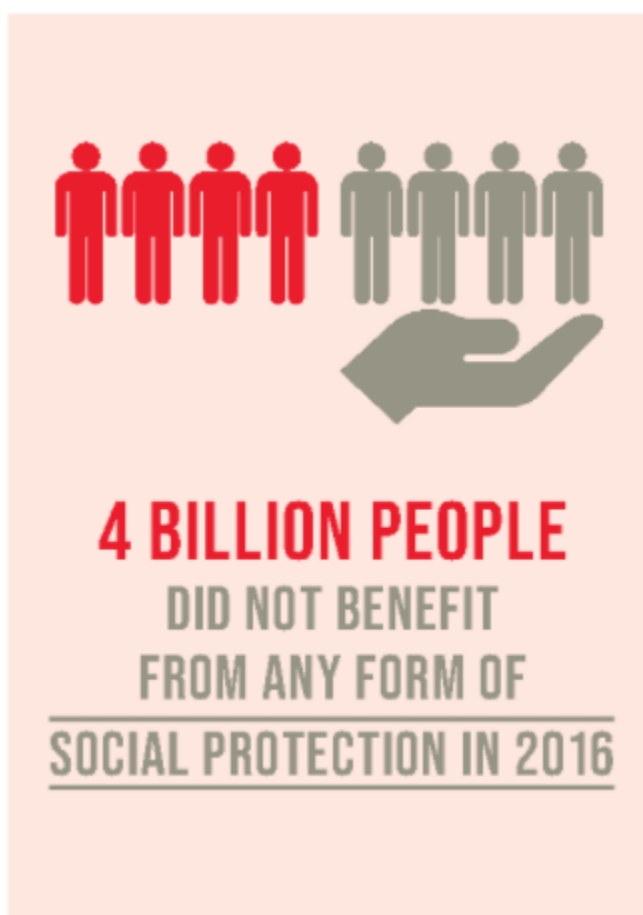
Figure 10. COVID 19 poverty implications



Source: UN Org, SDG 1, 2020

The figures of poverty are shocking, in the sub-Saharan Africa the vast majority live out \$1.90 (or less) a day. 10 percent of the world population, which is a bit more that 700 million people sadly live in extreme poverty, without access to basic needs, such us: Education, health, water and even sanitation. Rural areas still are the most vulnerable, accounting more than three times that urban or well developed areas. (UN Org, SDG 1, 2020).

Figure 11. Poverty - No social protection



Source: UN Org, SDG 1, 2020

2.3.3 SDG 2 Zero hunger

If the world succeed to create new jobs and eradicate somehow poverty, there will be fewer hunger and more access to food if SDG 12 could be also achieved. Anyhow, the world is not on track to achieve Zero Hunger by 2030. COVID-19 and heavy natural disasters has deepen this awful

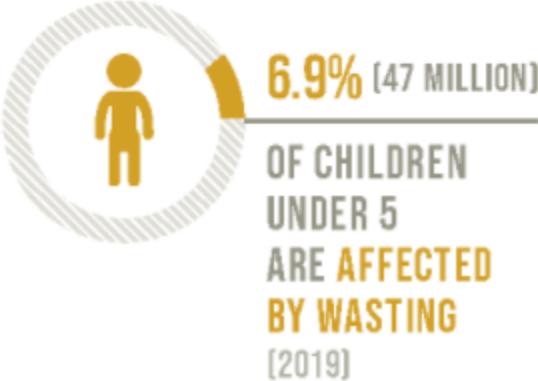
reality. If the world mismanagement last, the number of people affected by malnutrition on and hunger (extreme poverty) would exceed 840 million by 2030 (UN Org, SDG 2, 2020).

Wars, internal conflicts, economic decrease and strong climate change has increment drastically the number of people suffering hunger due to lack of food and resources, sadly COVID 19 could add 130 million to the already 135 million people suffering from acute hunger.

Transforming non valued fruits and vegetables to powdered ingredients and creating as an option, super food bars to bring food aid to those in need could definitely support those less favored that are struggling to survive of starvation and have it as relief to the countries with less resources or those how have been stroke harder by conflicts.

Figure 12. Stunting and wasting among children

STUNTING AND WASTING AMONG CHILDREN ARE LIKELY TO WORSEN



Source: UN Org, SDG 2, 2020

Furthermore, a specific strategy on global food agriculture should be place over the agenda if well developed countries have the intention to aid more than 690 million people who are suffering of not having sufficient food, but also having in mind that an additional 2 billion people (new comers) that the globe will have approximately have by the end of 2050. The increase efficient productivity and transformation is a must. (UN Org, SDG 2, 2020).

Figure 13. Small producers hit harder by the crisis



Source: UN Org, SDG 2, 2020

3. METHODOLOGY: ISHIKAWA FISH BONE MODEL AND CASE STUDY

After going through the literature review and understating main variables and figures that support this thesis, a three way methodology will be used to obtain, first and second hand information prior building a proposed circular economy based in Resource Recovery business model, and a case study to match with the impact of transforming non valued foods into ingredients based on the information provided by one interviewed company.

To start with, a self-made Food waste Ishikawa Fish bone model - causes and effects – with main factors that are causing food waste will be described and presented trough this chapter, considering this method supports the research and help to identify the root cause of a problem.

Found important to disaggregate as many causes as possible and initially not to look for solutions. The deeper the analysis, the better results can be obtained from this methodology. It is relevant to take into account that the fish bone is related to an extensive brain storm work trying to obtain the largest number of indicators and each factor must be analyzed, depending on its relevance, with the support of interviews that can give a better focus to the problem.

A fishbone model diagram, also related to cause and effect is a method for classifying the potential causes of a specific problem. As mentioned earlier, the main purpose of this method is to find the root cause.

This tool is about using many ideas from a brain storming in order to look into the potential causes of a identify problem, rather than focus only in a few.

Furthermore, an End user qualitative survey for Trends & acceptance will be deployed to a sample of 100 end users in different countries with the intention of understating their point of view about Circular Economy and to evaluate its ease to get involved and surf into new consumer trends by purchasing products made out of non - valued fruits and vegetables.

In a well-designed survey, uncover answers will be the most relevant factor, however, during the process, the survey should kept respondents interested about the topic and how it could helped them to understand new topics. Opinions, feedback and comments are very useful. The people who normally response are into in such a more private surveys, therefore, mobile phone survey (link) method was used.

The intention is to evoke discussion along the people who have answered and its friends - families placing interesting and well-designed questions. By doing this, respondents are more likely to gather information about key relevant topics.

As know, conducting surveys is a method to create balanced approach to decision-making and would support - somehow - base decisions on objective and relevant information and not about feelings or things that the creator would like to hear. By analyzing results, there is the opportunity to address topics of great importance to the topic, rather than waste time and valuable resources on areas of little or no concern.

Based on a Likert Scale methodology, the comments obtained are valuable and used as starting point to gather data on processed it over time.

Besides, a Producers interview – Raw material to final product have been conducted to identify the real business viability and with the intention to build a case study based on their information.

Written interviews for technical and commercial topics are very important because it allows the interviewee to correctly detail what he thinks and has the opportunity to leverage his answers with key information that could add value to an investigation due to its high information content. Additionally, the interviewees feel more confident to reveal information based on data, considering that the response time is superior to any other type of interview.

3.1 Food waste Ishikawa Fish bone model

Professor Kaoru Ishikawa (1960s) created the cause and effect Fish Bone Model as a technique that uses a diagram based approach for thinking through all of the possible causes of a problem. The fishbone diagram helps or supports owners / managers to analyze the main reasons, create programs to overcome the issues and try to mitigate failures or defects while the process.

The diagram looks like a fish's skeleton, usually the main problems is written inside the fish's head at the right and the causes for the problem would be placed on the spine, usually pointing out the most relevant variables of a process. A self-elaboration of Food waste Ishikawa Fish bone model will be developed on the following chapter.

3.2 Cause and effect (Self elaboration)

With the aim of developing the fish bone - cause and effect - model, the following steps were taken into account: Identify the problem, brainstorm the major categories (factors) of causes, identify the most relevant / possible causes and analyze the diagram.

First, the exact problem was identified and written down in a box to the right. Then, and using previous research to identify which persons might be involved, figure it out what the problem might be, and when and where it does occur. By drawing would provide enough space to insert the most relevant ideas. After developing all these steps, a better comprehensive understanding of the problem was obtained.

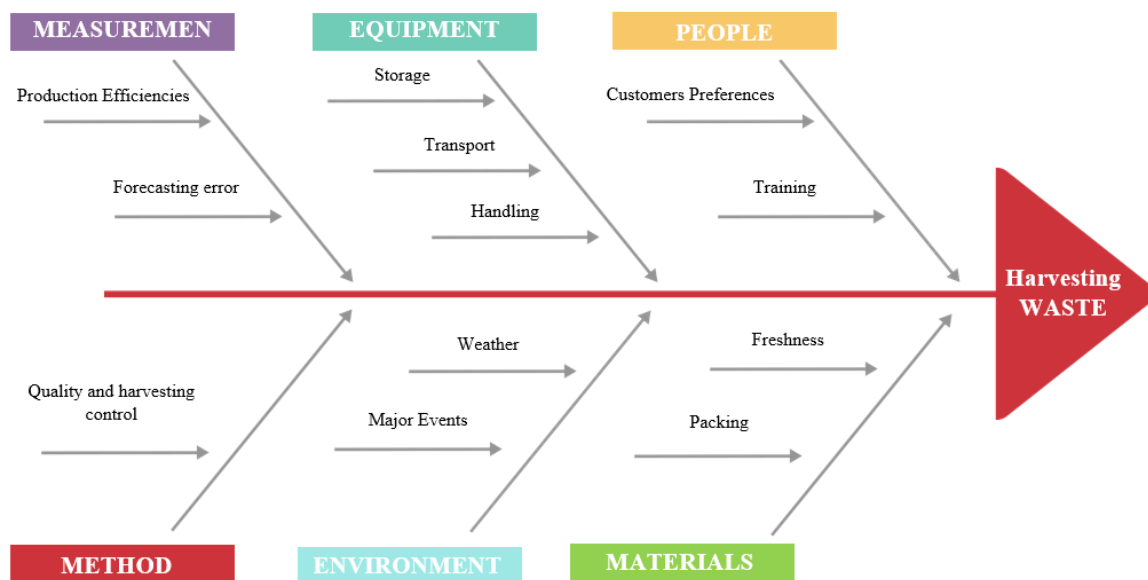
Second, the following factors were identified to address the problem: Measurement, Method, Equipment, Environment, People and Materials. Those factors are situated as main titles of the fish bone.

Third and consequent to the factor stated on the second step, the following causes were developed using a brain storm: Production Efficiencies & Forecasting Error, Quality and harvesting control,

Storage, transport & Handling, Weather & Major events, Customer preference & Training and Materials. Those causes specified on the bones of the fish bone diagram are the main reason of waste, and somehow are directly correlated to lack of initiative to transform, from raw to final ingredient.

Last, as step four, the diagram would be analyzed using the findings (Causes) and depending on the difficulty and importance of the problem a further analysis through interviews would be sort out in order to obtain better and professional insights.

Figure 14. Fruits and Vegetable Waste Ishikawa Fish bone model



Source: Self Made, Ishikawa fish bone model, 2021

3.2.1 Production Efficiencies & Forecasting error (Measurement)

According to the Table No.2 - Causes of Wastage (Spontaneous and multiple responses) based on the Spanish barometer designed by the Ministry of Agriculture, Food and Environment of agro-industry, out of the total sample (334) in 2015 - stated that waste is produced due to: Product has been spoiled (41.9%), over production (25.4%) and Bad crops (8.7%).

Those results support the fact that lack of measurement are one of the potential causes of waste, having production efficiencies and forecasting error as the most relevant factors.

Efficiency is to obtain desired results without waste (Cambridge Dictionary). For instance, the use of high-speed machinery to collect fruits and vegetables could improve the efficiency of the harvesting process and farmers could reduce cost through production efficiencies.

On the other hand, forecasting – considering the percentage of waste due to over production shall be taken into account and measured much more accurately establishing decisions on yearly data with the main purpose to bring down over production, reduce cost, waste and become more profitable.

Inspections (manual / automatic) and measurements to identify values of process, such as: pressure, volume, distance, and temperature) are techniques used by producers to monitor their crops, anyhow, measurements won't provide exact information, making it hard to use the data to obtain precise information that could support to fix a consistent cause of waste.

Currently, companies are using Artificial Intelligence-based forecasting solutions that automatically evaluate algorithms and safe historical data, patterns to make forecasting more efficient and effective (Correia, R 2020)

3.2.2 Quality and harvesting control (Method)

4. 5 % of the total produce in Spain is wasted due to quality control within different sectors. (Refer to table No. 2). There are several causes, nevertheless, the most relevant is the pressure exerted by consumers towards supermarkets to find / obtain perfectly shaped fruits and vegetables. This trend or demand has pushed retailers to become extremely careful with what they purchase from producers, leaving aside the product that does not meet current consumption visual standards and therefore, unconsciously - By consumers - generate waste.

Another cause, is the tag use by or visual perception of fruits imperfection due to short shelf life that led to waste considering lack of quality, in many cases the production is not able to satisfy the needs or requirements of the chain and its conditioning. On the fruits industry there are new technologies as APEEL, that has developed a new product that is edible and coats around fruits, especially avocados, with the intention to make them last longer and support unwanted food waste (Apeel, Food gone good).

Harvesting is co related to forecasting; the manual and relax overseeing method control used by many have proven to be somehow inefficient or needs to be improved. The strategies of the companies needs to be linked with the objectives, and the actions should cover a formal approach while addressing the processes. If actions are taken at the right time the quality of the products would improve.

3.2.3 Storage, transport & handling (Equipment)

Even though Storage, transport & handling are not mentioned on Table No.2 - Causes of Wastage (Spontaneous and multiple responses) based on the Spanish barometer designed by the Ministry of Agriculture, Food and Environment of agro-industry as main or potential cause, those factors are relevant to the supply chain and waste does heavily occur while manipulating fruits and vegetables.

As mentioned earlier, food is lost or wasted while all the phases of the FSC; storage, transport and handling have been improved over the years with regards waste, anyhow, there are still malfunctions on containers that ruins the food products. In order to mitigate, an extensive checkup shall be made before departing, considering that if the product gets bad while transporting, there will be waste on the badge but also prior waste in natural resources, like: land and soil.

Storage is a key function of a producer or distributor site, which involves holding and preserving goods (Using accurate temperature and techniques) from the time the products are harvest or produced until is delivered to final client for consumption. If the storage is managed properly, food would continue its normal flow to the market for final purchase and intake.

On the other hand, transport is a key to post-harvest crop management. All the foods that is needs to be transported, sometimes directly from the land to the market, but most of the times to a new packing house and storage. Even though food waste does occur due to lack of transportation, cannot be accounted to the idea of transforming non-valued fruits and vegetables to final product as off the product was in good condition but could not reached destiny worth of consumption due to different transport reasons. As example, some producers and exporters of fruits and vegetables lose their shipments due to malfunction of a refer container that present temperature control problem while on the sea freight.

With regards handling, special training and skills are compulsory a good job while harvesting, classifying and packaging of fruits and vegetables with the intention to provide excellent products to the market. This is the main objective of farmers, nevertheless, most of them are focusing in good shaped and fruits and vegetables, which is correct, but only few are considering that during handling there could be a process to separate imperfect fruits and vegetables that won't be sale and have a program to re-use instead of throwing it away. As mentioned by farmers in 2015, out of a sample of 334 companies, 51.5 % sated that they throw away its imperfect fruits and vegetables when asked, what the industry does with wastage - Spontaneous and multiple responses, refer to table No. 3.

3.2.4 Weather & Major events (Environment)

Weather conditions, earthquakes, typhoons, floods, among others are unpredictable factors that could damage someone field, but could benefit others (in different locations), businesswise. Even though Spain does not suffer quite a lot of natural disasters as other countries, still the environment

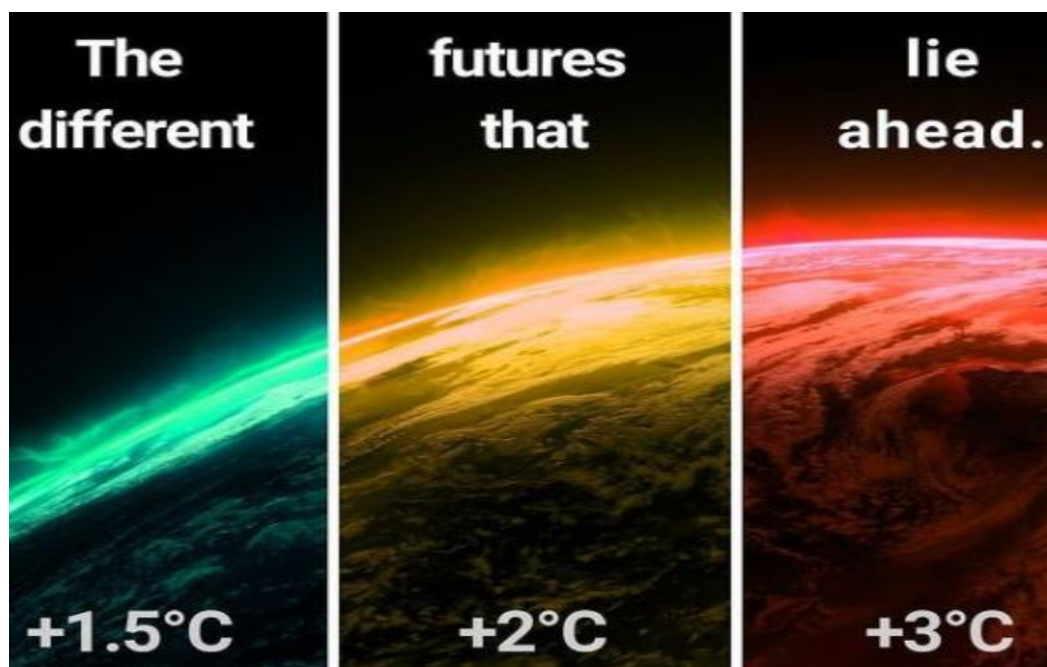
due to weather are predictable and can be considered manageable, anyhow, major events, like COVID 19, are some unavoidable environmental factors that no one was prepared for.

National conflicts, international wars and humanitarian crises due to natural disasters are increasing, resulting in devastatingly less access to education, food, public health and sustainable development. A large percentage of people living in low-income countries suffer from malnutrition, their children have trouble getting ahead. Many depend on international aid to get forward and seek new horizons; this generates waves of migration due to natural disasters or internal problems. (Food and Agriculture Organization of the United Nations Rome, 2017).

Global warming, as part of weather issues that will increase food waste, has capture the attention of many, and according to the United Nations, the difference between 1.5C, 2C or 3-4C average global warming can sound marginal. But, in fact, these temperature rises represent vastly different scenarios for the future.

Global warming affects humanity more and more and we have concrete actions to keep us safe, humans, plants and animals and also conscientious with the environment. There is an increase in the frequency of natural disasters and diseases caused by global warming.

Figure 15. Global Warming



Source: United Nations, Climate Change, 2021

3.2.5 Customer preferences & Training (People)

The trends of food consumption and the demand of customers has increased notably with respect to fruits and vegetables, the desire to obtain intense colors, suitable shapes and freshness has left aside the logic of food and protection of the environment and the spirit of circular agriculture.

However, there are many small initiatives to raise consumer awareness and protect the producer to persist in business, the vast majority continue to seek perfection, although the shape of the fruit or vegetable does not influence the food quality. This being a reason for waste but a great opportunity to mitigate the loss of food and transform it into final product and re-insert it as an ingredient in the food chain.

Nowadays, many fruit and vegetable producers hire cheap labor, without affiliations or proper training, which in some way will determine the effectiveness and the willingness to work. Workers are subjected to long hours of work, without prior training to handle food properly. During this process, many fruits and vegetables go to waste considering lack of knowledge, both to handle food, and to select those that are ready to eat.

In Spain, within the Valencian community, there are many crops of fruits and vegetables with product on the ground, which has not been collected for commercialization, but neither for transformation or reutilization. According to table No. 2; 7.2% of the surveyed farmers admitted that the loss of food corresponds to a weak commercial strategy which does not allow to sell everything what has been produced, thus generating waste, yet, reuse policies are not part of the main objectives of the farmers.

3.2.6 Freshness & Packing (Materials)

Lack of operator training can result in consequences for not using the company's materials properly, such us: Mistakes with labels and errors when placing products in the warehouses. Although it seems basic, these problems still exist, which are triggered in food waste.

The freshness of foods, especially fruits and vegetables, is extremely important when marketing them. As mentioned previously, large buyers are very strict about quality standards. The freshness of the fruits can be maintained for a specific period, but if there are no adequate marketing tools, the harvest can be spoiled. And it is actually what happens in many fields that produce fruits and vegetables. Apart from the problem that arises from commercialization, we have the problem of waste caused by lack of sale due to freshness. Producing companies aware of this problem and being an important cause for waste should use adequate strategies to measure freshness in time and evaluate what could be sold for immediate consumption or what could be processed as raw material to final product.

Agricultural packaging helps farmers and exporters to deliver fruits and vegetables in the handiest approach without any loss. Packaging - most of the times - prevents unnecessary waste post-

harvest and during the processes of production, storage and transportation. It ensures short and long-term stability between the farmers and consumers. However, economic limitations and price battles between producers, as stipulated in Table No. 2 (Causes of Wastage), 2.7% agreed that waste occurs due to price battle considering that large distributors – retailers obtain better prices by volume procurement, leaving a priority group of producers the opportunity of reinvesting and improving their packaging practices to enhance relationships and increase sales, while those affected by the price battle find it difficult to invest in adequate packaging.

3.3 End user qualitative survey – Trends & acceptance

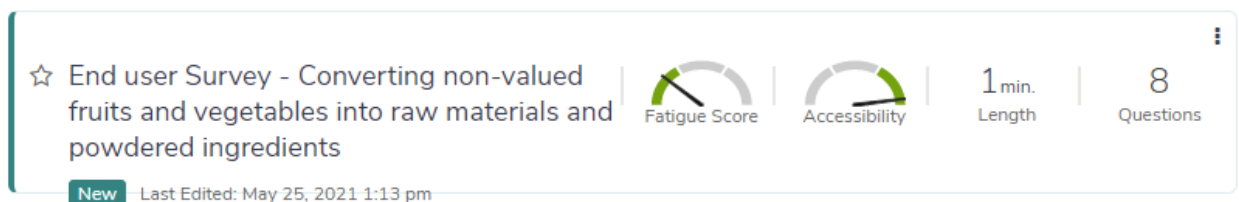
The intention to engage with an end user customer via a qualitative survey is to fully understand food consumption trends and acceptance of non-valued products. The questions we carefully designed to match the objectives of this thesis.

In order to obtain different variables (responses) out of each question, Likert Scale method was applied. Furthermore, a survey pilot to 5 people was conducted, in order to analyze their impressions about the clarity and simplicity of each question, before sending to the target (100) sample, which was formed by people between 25 and 55 years old, from different nationalities, including Spaniards and Ecuadorians, also to people from the same nationality but living in Japan, United Kingdom, Germany and Australia.

Additionally, and after researching how to come out with a success survey project, a test to measure Length, Fatigue and Accessibility was conducted with the intention of making sure that participants can and will participate.

On the graphic bellow, results of the test that prove that the survey conducted was within the recommendable limits to obtain positives results while participants enjoy solving the questions.

Figure 16. Survey: Fatigue, Accessibility and length test



Source: Fatigue, Accessibility and length test (Alchemer), 2021

3.3.1 Analysis

As mentioned above, 8 questions were conducted to better understand trends and acceptance and tackle unknowns about general knowledge of food loss, intention to support businesses by purchasing manufactured products out of the potential waste, and the importance of circular economy within the farms. 3 of them will be analyzed through this section, the others would have the most relevant data and the full report would be on Appendix 1. Participants solved the following:

Table 6. End user qualitative survey – Trends & acceptance

No.	QUESTIONS
1	Are you aware that, roughly one - third of the edible parts of food produced for human consumption, gets lost or wasted globally, which is about 1.3 billion ton per year?
2	Would you buy a product from the one - third of the edible parts of food produced that is wasted?
3	Would you buy a product manufactured from this one - third that is wasted, considering that it cannot be sold because of its shape or size?
4	Do you agree that imperfect fruits or vegetables (Lack of cosmetics) possess same amount of nutrients as perfect shaped fruits or vegetables?
5	Do you agree that responsible consumption and production guarantee sustainable consumption and production patterns?
6	Are you looking for products that, among other indicators, place on its packaging the following labels: Fair Trade, 100% natural ingredients, Ecological, Organic, Circular economy?
7	Do you think that the Circular Economy business model should be used by fruit and vegetable farmers?
8	Would you get involved in new consumer trends, like Airbnb farming, to prevent farmers from wasting?

Source: Self Made, end user Questions, 2021

With regards question No. 5 (Do you agree that responsible consumption and production guarantee sustainable consumption and production patterns) and the data below, shows that the vast majority agreed (44.2 %) and strongly agreed (47.1 %) that responsible consumption and production could guarantee sustainable consumption and production, somehow, most of them are in the same line as SDG No. 12: Responsible consumption and production - Ensure sustainable consumption and production patterns. These results are very positive, even though, 35.6 % is somewhat aware

(There should be more information) of the amount of food wasted per year, as per the results of question No. 1 (Are you aware that, roughly one - third of the edible parts of food produced for human consumption, gets lost or wasted globally, which is about 1.3 billion ton per year)

Table 7. Results of End User survey – Question 5

Value	Percent	Responses
Strongly agree	47.10%	49
Agree	44.20%	46
No opinion or uncertain	3.80%	4
Disagree	3.80%	4
Strongly disagree	1.00%	1
Totals: 104		

Source: Self- Made Results of End User survey – Question 5 (Alchemer), 2021

On the table below, which represent the data of question No. 7 (Do you think that the Circular Economy business model should be used by fruit and vegetable farmers), the majority of the responses (94 out of 104) agreed with 47.1 % and strongly agreed with 43.3 % that farmers should you use or implement circular economy business model. Less than 9 % are uncertain, disagree or strongly disagree.

Costs, margin and benefits are distributed and studied alongside production and consumption, therefore, it is very relevant to keep products and materials with the highest and well tested utility to gain value at most of the times in order to becoming full circular.

Pointing out of what has been stated by the people about question No. 8 (Would you get involved in new consumer trends, like Airbnb farming, to prevent farmers from wasting), there is a clear message that people is much more into new trends that could support farmers, waste and mutual development and support, having 92 people out of the sample (104) saying that they agree (51.9 %) and strongly agree (36. 5 %) immersing themselves in new trends, such us Airbnb Farming, which was created to Co-investing (Purchase) in the production of a tree (e.g. oranges) for determined period and have it delivered at your doorstep. This initiative began due to low prices paid by supermarkets and other intermediaries to small farmers (Making almost impossible for living). On top of that, part of the harvest would always go to waste because they couldn't sell it.

Table 8. Results of End User survey – Question 7

Value	Percent	Responses
Strongly agree	43.30%	45
Agree	47.10%	49
No opinion or uncertain	7.70%	8
Disagree	1.00%	1
Strongly disagree	1.00%	1
Totals: 104		

Source: Self- Made Results of End User survey – Question 7 (Alchemer), 2021

3.3.2 Potential market

The powder market has increased globally and the trend will keep moving on. As per compound annual rate (CAGR), during the period, 2020 to 2025, there is a forecast growth rate of 4.15 %. (Mordor Intelligence, 2020)

Considering question No. 3 (Would you buy a product manufactured from this one - third that is wasted, considering that it cannot be sold because of its shape or size) and the table below, the results show that 39.8 % (the majority) stated that sometimes while obtaining groceries would purchase a product manufactured out of the one - third that is currently wasted.

7.8 % said that hardly ever would purchase a product manufactured out of the one - third that is currently wasted, and 11.7 % happily accepted that they almost always would purchase a product manufactured out of the one - third that is currently wasted. Leaving a potential gap to transform non valued fruits and vegetables and transformed them into raw and powdered ingredients for manufacturing an end user product.

Table 9. Results of End User survey – Question 3

Value	Percent	Responses
Hardly ever	7.80%	8
Occasionally	19.40%	20
Sometimes	39.80%	41
Frequently	21.40%	22
Almost always	11.70%	12
Totals: 103		

Source: Self- Made Results of End User survey – Question 3 (Alchemer), 2021

Even more, according to a forecast study designed by Mordor Intelligence, the fruit powder market goes along with the intention of new consumers to become more conscious about health, to gain positive habits towards healthier lifestyle, and the most important and relevant to the main topic is that users of artificial ingredients are largely shifting to 100 % natural products.

The forecasted period (2020 – 2026) reveals that there will be an increasing demand for super fruits powders and it is anticipated to become one of the most relevant driving forces that will support the growth of the market, thus more customized powdered ingredients are around the market to fulfill this significant trend.

After researching while working on the thesis and revising the industries that use powdered ingredients, I found that the main users are: Sauces, soups, beverages, dairy, bakeries, snacks and confectionery.

Even if it is painful and very sad, the Covid 19 outbreak, has meant an important benefit to fruit ingredient manufacturers, mainly on industrial level, considering there was a large demand of this type of products while lockdown, considering there was shortage of fruits and vegetables and difficulties for transportation. Even more, most of people while Covid 19 outbreak, began or increased consumption of processed and packaged food products; this considering availability, products charge with healthy fruits ingredients, and the duration of it.

3.4 Case Study / Producers interview – Raw material to final product

The intention of contacting expert producers of raw materials lies in generating a balance between desktop and field research with the reality that producers live, identifying business viability, supporting the economic, commercial, social and environmental aspect as a reference to obtain first-hand information and identify the reality of the industry.

The information collected serves as a study method – case study - about one of the companies that have answer the written interview, and the information will be used to analyze the impact of the business procedure in the following chapters. For this, relevant information from the companies has been collected, their appreciations and suggestions about relevant issues to develop the business properly, being sustainable and how useful it is to re-use non valued foods and transform them into ingredients.

Apart from the written interview, the opportunity to discuss and understand that the transformation and recovery of non-valued foods is rapidly increasing in trend due to socio-cultural factors, as well as profitability for companies. It is interesting to know the potential of the business that aims to conquer the world food industry and from its hand protects food waste. Correctly food process generates a positive cause, especially for producers who are associated with non-profit organizations whose objective is to purchase nutrient-rich foods from fortified ingredients to nourish – somehow - the most affected, in term of hunger, countries of the world.

3.4.1 Analysis

The following questions were developed with the intention of understanding economic, commercial, social and environmental aspects first hand and with the intention to build a case study using real data with the intention to approach the impact of transforming non valued food into raw materials or ingredients. These would support to identify the viability of the business.

Table 10. Producer’s interview – Raw material to final product

Aspect	QUESTIONS
Environment	Do you agree or believe that a Circular Economy Business Model could reduce waste of fruits and vegetables and launch a positive habit of reuse raw materials to convert them into ingredients? How viable is it to access non-valued fruits and vegetables?
Social	Do you believe manufacturers could hire more staff to transform raw material into ingredients? Has your company (or stakeholders) increased harvesting staff for this purpose?
Commercial and Economic	How viable is it to transform non-valued fruits and vegetables into a new trend product? Would you implement the process of transformation if profitable for your firm?

Source: Self Made, producer’s interview, 2021

The selected companies operate in different parts of the world, including the multinational Diana Foods, the revolutionary Spanish startup Agrosingularity, and Ecuador's first biotechnological company, Dlip Industrial. Their experience in the field and industry has been relevant to identify problems and solutions to achieve an adequate transformation.

Diana Food, as per their site, is a reliable partner that take very serious clean label about natural ingredients. They work and processed well selected raw products - including fruit and vegetables which are the main relevant for the thesis purpose. They are offering to its client's functional and diverse benefits such as: Texture, color and taste, aiming food protection and health actives.

The products of Diana Foods are distributed in 90 countries worldwide, their products enable all types of industries – like; beverage, food, nutraceutical and even baby food, to develop goods with impactful and trendy claims with the intention to meet expectations and emerging trends.

Diana Food greatest asset is its people. Our team of in-house agronomy experts works closely with farmers all over the globe to deliver the best raw materials performance while fostering sustainable agriculture practices. Our employees are passionate, dedicated and always put customers' needs at the forefront. (Bohin, Fabrice BOHIN, Diana Food President)

Symrise is one of the world's most successful ingredient manufacturers, with an annual turnover of more than 3 billion euros. Consumers interact with Symrise products on average 20-30 times per day. From the minty freshness in their toothpaste, to the spark of special scent that makes their favorite perfume irresistible, to the food they eat and the beverages they drink, or the treats they give to their pet – Symrise solutions enrich consumers' lives the world over.

Since its origin, Diana Food has developed a business model that focuses on creating added value from vegetable and meat by-products and side streams. Therefore, sustainability has always been a fundamental element of our business model. We are committed to sharing value with all our stakeholders – suppliers, customers, consumers, employees and communities – as well as society and the environment.

Sustainability is positioned at the very heart of our strategy, exemplified in our efforts to foster responsible innovation and strive for responsible sourcing while minimizing our environmental footprint. This concept is embraced across our entire organization, further evidenced by our parent company. Since 2014, Diana Food has been part of the Symrise Group, a sustainability-award winning leader in taste solutions, nutrition, and scent and care. With Symrise, we have set the goal to operate climate-neutral by 2030.

Figure 17 Diana Food, Transformation to puree range



Source: Diana Food, Puree range, 2021

On the other hand, Agro singularity, the revolutionary Spanish start-up, as per the website, thanks to their support system, they provide processing solutions so that fresh products can become raw material for the food industry, ensuring quality, safety and traceability of all of them. (Agro singularity, 2021)

The most relevant features are: All the ingredients are produced locally and distributed, each product has been made at origin, bringing value to the entire food chain. Their ingredients are produced from non-valued vegetable, fruit and vegetable products. Making food production sustainable. Agro singularity improves the cost of use of food recipes, reducing procurement times and stocks needed by brands. Their products are suitable for food mixes, pasta, sauces, supplements, snacks, bakery, among others.

The impact measurement of its activity as follows: 2,061 TN GEI reduced, 54.81 produced ingredients and 490 TN fruits and vegetables recovery.

Figure 18. Agro Singularity, Non Valued food into raw materials



Source: Agro Singularity, Non Valued food

Last, DLIP industrial, as per their site, founded in 2010, DLIP INDUSTRIAL S.A. is an Ecuadorian family company specialized in functional and nutraceutical superfoods, in powdered or liquid form. 100% natural products, gluten free, NON GMO. The raw materials are obtained from the Andean and Amazon region such as; cereals, fruits, vegetables and medicinal plants, which combined with high technology “Spray Dry” hydrolysis and/or micro-encapsulate, will help preserve the unmatched properties of the natural product, ensuring an incomparable shelf life and a high added nutritional value. This technology allows the magnification of scientific processes, resulting in the development, production and commercialization of products of natural origin, with the best quality standards.

Being a versatile company DLIP INDUSTRIAL S.A. counts with a Research, Development and Innovation Department to create “Tailor Made” products. Develop specific formulas to meet requirements / needs or consumer trends identified by their customers. DLIP INDUSTRIAL focuses on local natural resources to create economic and employment opportunities for the region.

Figure 19. Dlip Industrial, Fat Burner out of ingredients



Source: Dlip Industrial, Fat Burner

3.4.2 Business and trends viability case study / according to the point of view of the interviewees

The full responses of the questions that aim to identify business and trends viability are on the appendix of this thesis on Spanish, nevertheless, in this section the most valuable answers regarding Social, Economic and commercial aspects would be stated.

According to Daniel Andreu, CEO of Agrosignularity in response to the environmental aspect, focusing on Circular Economy and the accessibility to non-valued fruits and vegetables, mentioned (Translated to Spanish to English) the following:

“In full agreement, the circular or Upcycled economy model not only has the capacity to value and contribute to a positive impact on the environment, but by taking advantage of these losses we are able to use active ingredients to produce new, more functional and nutritious foods, fighting deficits as important as protein, dietary fiber or intake of vitamins and minerals”.

On the other hand and considering accessibility to non-valued, Andreu mentioned that “It is currently considered a structural decline, in the primary sector (agriculture), an average of 7% per year is lost and in the agro-industrial sector (juices, preserves, manipulators), around 40% of the original product is discarded by manufacturing processes, currently in Spain this amounts could be about, 3.3M TN / year”.

With regards social aspect and the question about hiring more staff, he mentioned “It is not a question of more hiring but of lengthening the production chain, contributing to more hours hired by the current staff, 90% being Men in Agriculture and 90% Women in canning, it has a positive impact on the maintenance and dignity of work”.

Taking into account the commercial aspect, Andreu has provided a chart (to be analyzed on the economic, environmental and social impact) made about how a company performing upcycling tasks could increase its turnover and improve the workforce, and has answer the following question - how viable is it to transform non-valued fruits and vegetables into a new trend product? With - “The great "challenge" is logistics, the key for economics units is to be viable in the creation of this new business model. Another aspect to consider is the "cost of processing" since being a volume business, these costs are the ones that at the end of the year allow you to have a positive revenue”.

On the other hand, Santiago Yanez – Global product manager for Diana Foods has stated the following with regards environment aspect. “I totally agree that a circular economy model could reduce the waste of fruits and vegetables and for instance transform them into ingredients. For the viability, first it will depend in different variables. For example, in the case of Ecuador, Diana Food-Part of Symrise, produces banana puree and dried products and we have around 30,000 ton/year of banana peel (now as waste) that we are trying to sell it as Banana peel powder as an ingredient”.

With regards employability, Yanez answer the following question; has your company (or stakeholders) increased harvesting staff for this purpose? With “No. Because we still haven’t been able to sell all the 30,000 ton of banana peel as an ingredient. If do it, then there will be for sure an increase of staff at the factory”.

Furthermore, and having the commercial aspect as key variable, Yanez mentioned that the transform of non-valued fruits and vegetables into a new trend product, “It is possible thanks to different technologies” and also mentioned that his firm is currently implementing the process of transformation, - from raw to ingredients -, since they found it profitable.

To finalize, Catalina Polanco, International Business Development Manager of Dlip Industrial has stated the following as summary of the questions: “There is a big volume of waste from fruits and vegetables, they should be reused as ingredients. For this, transformation and recovery industries are required of the important elements that within the circular economy model generate ingredients with high added value”.

With regards staff hiring, “Definitely when creating new industries there would be greater job opportunities. At this moment the culture of the value of fruits and vegetables waste is not enough, we must understand that maintains an important contribution of vitamins and minerals”.

“Possibly, 70% of household waste is organic waste, so it would be important to transform it into resources. In addition, it reduces methane, a toxic gas and reverses climate change”.

“From my point of view, it is viable, it is important to take advantage of the complete life cycle of food; In addition to replicating the way that nature has to treat waste and convert it into beneficial and regenerative products, with great social, economic and environmental benefits”.

4. RESOURCE RECOVERY BUSINESS MODEL AND CIRCULAR ECONOMY IMPLEMENTATION

Once the theoretical framework has been analyzed with its respective statistics relevant to the subject of this thesis, the methodology used to know the root cause of the problem and the analysis of business viability through written interviews and surveys; this chapter will suggest for the main actors a circular economy resource recovery business model which could be implemented in a fruit and vegetable producing companies.

The next topics will analyze the importance of circular economy for producers, the meaning of resource recovery and its benefits, a design of a canvas resource recovery business model with the main actors of the food supply chain in order to mitigate food waste and transform it into raw materials for the elaboration of a final product.

4.1 The importance for producers

The most important bit of Circular Economy for producers is sustainability that leads to productive agriculture. Because the Circular Economy aims, first of all to protect the environment, pollution and the most important resources, while attempts to develop economic, environmental and social prosperity, and second of all – promote the much needed sustainable development (Burgo-Bencomo et al., 2019).

Therefore, and taking into account different approaches, circular economy based on the agriculture industry should become a vertebral column of the world wide economy, with the intention to ensure economic sustainability (Bos and Broeze, 2020); also relevant to protect and try to make a long last biodiversity and conserve productivity and natural resources over time aiming a sustainable environment (Jun and Xiang, 2011); and, last but not least, to gather enough funds to ensure food security for all, eradicate poverty and malnutrition with the objective to provide health and social development (Burgo-Bencomo et al., 2019; Kristensen et al., 2016).

4.2 Resource recovery

The correct management of resources could lead to a precise decision making and sustainable practices that would lead to economic benefits, ensure greater value added products and maintain natural resources available for the production much longer. (Ruiz et al, 2019)

The most relevant sources in circular economy are: Water, energy, energy, capital, time and avoid as much as possible waste. Therefore, these should be optimized in order to seek a prosperous business model. (Jurgilevich et al., 2016; McCarthy et al., 2019; Sherwood, 2020).

Furthermore, it is widely recognized, and now a days place into practice, that in order to create a circular agriculture, companies have to look deeply into different ways to maintain and also improve the environment and ecosystems, having as a principal objective, to be regenerative (Morsetto, 2020).

Additional, agriculture got to improve focusing on close nutrient loops, maximize them and create long term value products, but also minimize the impact to the environment and engage into sustainability. By doing this, companies are developing a circular production model following resource recovery. (EMF, 2015; Morsetto, 2020).

4.3 Resource recovery Business Model

With the following - Canvas - Resource Recovery Business model, this dissertation suggest a model that could be applied within the agricultural, fruits and vegetables, industry with the aim to transform waste, or not use, to a powdered ingredient or raw material for developing new products.

In order to analyze the Resource Recovery Canvas Business Model, each step was linked to the main topic and though about the ease of doing it, therefore, a precise summary would be deployed within this chapter.

Before proceeding, it is important to have a definition, thus, placing different concepts together; in reference to the main topic and the agriculture industry; Circular Economy, focus on the regeneration of agro systems and the nearby ecosystems, pursue efficient and effective use of

natural resources along the value chain and aims to ensure economic, environmental and social impact.

Table 11. Resource Recovery Canvas Business Model

Key Partners Reverse logistics chain. Waste Management, municipalities and re-using companies.	Key Activities Recovery of products at End-of-Life	Value Proposition Sustainability: Environmental sustainability of recovered materials. Lower cost: Discount prices for transformation	Customer Relationship Generally transactional but also ideological	Customer Segments Secondary material commodities companies & internal procurement customer in a fully closed-loop model
	Key Resources Plant and equipment for recovery processes. This could be outsourced to a Key Partner		Channels Market for recovered products. Producers of fresh and processed fruits and vegetables	
Cost Structure Reduction of own disposal costs which the company may have to otherwise incur			Revenue Streams Waste as Value. Sale of recovered product direct to the customer (Producers of fresh and processed fruits and vegetables)	

Source: Self Made, Resource Recovery Canvas Business Model, 2021

4.3.1 Recovery of products at End-of-Life (Key Activities)

The term End-of-Life normally refers to materials, however, it could be addressed and referred when the product no longer satisfies the last user or the channel, in this case, final client and clients (Distributors – Retail).

Recognizing that there is carefree or lack of processes to recover food products is the initial step in making relevant decisions and identifying or exploring different options to relocate products that are not suitable for our current customers.

As previously indicated, fruits and vegetables that do not meet the standards imposed by supermarkets and customers become an end-of-life product. If the symmetry is not perfect or according to specifications, it is simply discarded and set aside, generating waste of food loaded with the same nutrients as products that comply with the regulations.

One of the key activities of a company should be to create and diagnose big data about the harvest, with the aim to know what percentage of the production will not be bought, and make the right decisions to market that product to organic natural supermarkets, or try to use different marketing initiatives to reach people who don't mind about the shape of a product. Furthermore, the non-valued product can be processed and transformed into an ingredient for the production of the final product, making waste part of a revenue.

As example, Mercadona, the Valencian Retail, has started to reuse resources and began to transform not used plastic and carton into final products (Bags) that are useful for clients, having a big impact about sustainability, circular economy and empowering its image as friendly with the environment.

Figure 20. Mercadona - Resources (Previous waste) into final products



Reference: Mercadona, re use of materials, 2021

4.3.2 Reverse logistics chain (Key Partners)

Reverse logistics analyses and address the backwards flow of the companies, beginning with the phase of consumption – final clients, down to origin – producers to seek where might be available spots to improve and recapture value, therefore, firms spend vast amount of economic resources to implement, control during all the phases and plan cost effective flow of raw materials, finished goods and inventory.

Normally, the most analyze flow goes from origin to consumer, nevertheless, reverse logistics is quite new business concept that has helped companies to identify, improve and supervise its operations to generate value while processing. (Bernon et al, 2010).

On the other hand, waste management aims to properly coordinate the dispose of waste. It can be by discarding, destroying, recycling, with regards the main topic of this thesis, processing and reusing are the most relevant for controlling waste. The prime objective of waste management is to decrease the quantity of unusable product – not valued - and to avoid possible health and environmental difficulties.

The fruit and vegetable producing companies through their representatives could request support from the municipalities or responsible governments to acquire training in reverse logistics and waste management, funds and even a strategic public-private alliances to develop joint projects whose main objective could be to reduce food waste by joining forces to develop end products based on non-valued raw materials.

If the public agenda does not specify the reduction and transformation of non-valued foods, there are currently companies that are dedicated to buying non-valued fruits and vegetables to transform and sell them. The important is to have Key Partners around, to improve waste and therefore, support the environment, but also - to generate income or revenues from the efforts made.

4.3.3 Plant and equipment for recovery processes (Key Resources)

The processing plant and the equipment (Spray Dry) needed to transform raw products into final ingredients has become an investment challenge for producers, however, some multinational has bet on it a place its own processing plant, while others have outsourced the service to a key partner.

Large companies with access to superior credits and better financial conditions have opted to close the productive circle, from producing fruits and vegetables, distributing them, marketing them, and now include transforming non-valued ingredients to final products. These companies have potentially increased their productivity, waste cero has become primarily involved in its objectives.

The percentage of companies with the ability to close the productive circle is minimum. Therefore, producers with less capacity can outsourced the transformation service to one of their key partners or sell the idea of a new business model that is derived from non-valued fruits and vegetables.

4.3.4 Sustainability and lower cost (Value Proposition)

There are two relevant approaches as value proposition for the resource recovery canvas business model, Sustainability to address the environment and recovered materials / products and Lower Cost, with the aim to provide discount prices of non-valued products for transformation.

Sustainability has become a trend, and now more than before and ever, governments and companies under their communication strategy strongly promote sustainability and good practices for the environment, the way in which natural resources are used and what makes production processes consistent, to better take care of natural resources. Apart from making an intelligent contribution to the environment, companies that maintain clear sustainability objectives are better valued, and their reputation as conscious sustainable companies allows them to access new markets, with greater demands and with significant volumes. For this reason, many fruit and vegetable producing companies promote sustainability, research to improve in this field or matter and even designate economic funds to help their suppliers improving theirs processes.

On the other hand, it is essential to reduce production costs, eliminate waste, in time as well as in processes, to be able to offer non-valued products with significant discounts to processing companies. The strategic alliances seek to gain / gain, from the parties involved, regarding the specific subject of this thesis, the producer manages to sell, at special prices, part of its volume of not valued products to companies dedicated to transform and process, thus obtaining economic income for a procedure that in the past was considered, waste. Since the trend of consumption of foods based on natural ingredients has increased, the practice of making the most of crops will potentially increase.

The value proposition for a business is extremely important, normally companies with innovative ideas try to present unique and disruptive proposals, which is aligned with the companies (some presented on the previous chapter) that are leading the transformation of non-valued products, however, the value proposition for the producers or farmers, in some way will remain quite the same, being sustainable over time and generating profits while selling the waste.

4.3.5 Secondary material (products) commodities companies & internal procurement customer in a fully closed-loop model (Customer Segments)

Segmenting customers is essential to properly reach the products that need to be promoted. With reference to the subject of this thesis, and considering that the evaluated product is not valued and requires a process to commercialize it, two relevant options have been identified: the first and most important; companies that buy products of this category and as the second option; internal purchase - in order to create a new business model within the company that could be able to measure it properly without harm current product or processes.

The main customer for non-valued fruits and vegetables are the companies that transform raw material into ingredients for the production of final products. At the moment, a large percentage,

as explained in the previous chapters, of food is wasted because of its shape or lack of cosmetic that does not comply with the high standards of many supermarkets / distributors. Several companies, especially multinationals and other innovative ventures, have seen waste as an opportunity and have become main customers for farmers who have the need and willingness to generate economic resources through food waste.

Additionally, another client could be the same company, through the creation of a subsidiary that is in charge of buying / transforming and then selling, having created a different option. Bearing in mind that is import to maintain an independent fully closed commercial loop with the intention of not affecting the main fruit and vegetable market business, but with the purpose of innovating, growing, contributing to the environment and diversifying its production.

4.3.6 Generally transactional (Customer Relationships)

Relationships with clients in this type of business are initially defined by affinity and empathy towards the environment and waste, to formalize, as in all businesses, a contract should be made to established terms and scope of the project.

It is relevant to identify the approximate volume of production of non-valued fruits and vegetables or to stipulate in the clusters that, as it is a food product, it is not possible to know with certainty the waste, even more - considering that technology supports the farmers in order to have less waste while availability to invest on it.

This applies to external or internal clients, being recommended at the beginning, to sell to an external taking its knowhow as beneficial for both parties, yet, reducing pressure on investment, processing and commercializing the product.

4.3.7 Market for recovered products (Channels)

Companies should aim to introduce their products into the Market for recovered products, which involves, producers of fresh and processed fruits and vegetables.

The commercialization channel allows the company to sell and distribute food products more efficiently. Companies dedicate time and funds to develop, maintain and improve it over time. There are traditional channels such as direct sales, however, during COVID 19 companies developed new online channels to market their products. Farmers whose objective is to boost the economy and take care of the environment through the commercialization of non-valued products must add a new channel to their traditional to reach the market for recovered products.

As a strategy or alliance between the interested parties, and considering that the main interest (to develop new income) of the producers of fresh fruits and vegetables is to reduce waste, generate economic resources and support the world cause of caring for the environment; the channel to be

developed is for food processors, whose objective is to use the raw material to create new recipes based on healthy ingredients.

On the other hand, the development towards zero waste involves all stakeholders, especially those most interested. As a second option, processed producers should be open to using non-valued products for their recipes, taking into account that the vast majority of the product maintains the same properties. The commercialization channel has to flow without many setbacks considering it is a win-win, now - not only for the companies involved but also for the environment.

4.3.8 Reduction of own disposal (Cost Structure)

The cost structure represents the profit margin for each product. The finer the structure, the more income the company can generate. Any oversized or miscalculated cost suggests reduce to income and is considered structural waste.

The current waste reduction sustainably improves the development of agricultural producers. Promoting ideas or introducing unaccustomed processes requires investment and identification of impact on product costs, however, it is necessary to separate the products and carry out specific cost, new techniques lead to a new business model. As mentioned above, it can be through company investment or by outsourcing the service.

The less waste is generated in a company, the greater the benefit in: Productivity and efficiency. In difficult times it will be necessary to adjust and use raw materials to the maximum and explore consumption trends that can support any decision to improve waste.

4.3.9 Waste as Value (Revenue Streams)

A business model is not valid without the proper identification of economic income. In this particular case, the income comes from food waste, which potentially means business development. What was previously inconvenient to locate, burn or evict, now becomes an additional opportunity to generate resources. Socially and entrepreneurially, it is motivating to start generating more, based on food waste.

Under this model, waste creates value and enhances agriculture in general, taking into account that trends point to reusing raw materials and that a multiplier – convert - effect may arise. If a farmer does it and does well, many will follow its footsteps. By doing this, it will be possible to reduce food waste and promote sustainable products that follow the principal of converting with the aim of supporting those in need, as the main choice, but also serve to produce high-level nutritive products that can be promoted on the shelves of supermarkets, beginning at national level but with the purpose of reaching other countries.

4.4 Circular Economy implementation – Harvest and Industry

The intention to reduce end of life with the reduction of waste, instead of throwing away, recycle and recovery of materials while producing, better distribution and conscious consumption, with the objective to achieve sustainable development is very relevant to leave better quality of life and improved economy for the future generations. (Kirchherr et al, 2018)

Most circular economy processes are focused on materials, however, today the concept of circular economy goes further and proposes friendly and sustainable strategies for different industries and services. The intention of this thesis is to reduce the waste of fruits and vegetables by proposing to use non-valued foods to transform them into ingredients, this being the main value proposition of a winning business model: Which generates economic resources for companies, but it also contributes to the sustainable development goals. In addition, it promotes a circular culture which aims to return to the earth what has provided, after using or consuming it.

The following circular economy proposal is based on the previous - resource recovery business model - and its key points, as main bit, the availability to convert raw and non-valued material to ingredients, for final products.

Figure 21. Circular economy; harvest and industry



Source: Self Made, Circular Economy, harvest and industry, 2021

5. RESULTS: IMPACT EVALUATION BASED ON THE AGROSINGULARITY CASE STUDY

To effectively measure the economic, environmental and social impact of a new food transformation process, information and business projections from several companies are required, in order to gather data, make an average and draw conclusions, however, the transformation of non-valued fruits and vegetables to ingredients to final product, it is a recent concept, which lacks statistical information.

In any case, this thesis has collected relevant information, both - public statistics on food waste and what is done with it, and precise information from private companies that are dedicated to the concept of transformation of non-valued food; this being sufficient data to generate hypothetical projection of the scope of this concept, in economic, environmental and social terms.

The main statistic to be analyzed in the following topics, will be the chart presented by the Spanish company Agro Singularity while filling the written interview, bearing in mind the impact that a new concept can create in the economic, environmental and social aspect.

The following table represents the current reality and projections of Agro Singularity, how well they are progressing with this laudable mission and specific data regarding: Kg sold, value in tons of recovered food, not emitted Green House Gasses (GHG), jobs generated, and new positions for people in social exclusion.

Figure 22. AGROSINGULARITY - Companies performing upcycling tasks could increase its turnover and improve the workforce

Año	2020	2021	2022	2023	2024	Total Acumulado
Facturación Agrosingularity						
Kg Vendidos Agrosingularity (Kg)	77.524,80	113.523,20	280.402,40	367.327,20	539.971,20	1.378.748,80
Alimentos recuperados Agrosingularity (Tn)	588,41	861,64	2.128,25	2.788,01	4.098,38	10.464,70
G.E.I no emitidos Agrosingularity (Tn)	2.471,34	3.618,89	8.938,67	11.709,66	17.213,20	43.951,75
Puestos de Trabajo Indirectos Agrosingularity	23	23	28	30	40	40,00
Colaboradores OPFH Agrosingularity	3	5	5	8	10	10,00
Media Trabajadores OPFH	348,00	580,00	580,00	928,00	1.160,00	1.160,00
Facturación Media OPFH Colaboradoras	34.725.000,00 €	57.875.000,00 €	57.875.000,00 €	92.600.000,00 €	115.750.000,00 €	358.825.000,00 €
Impacto sobre OPFH (kg)	353.936,88	610.236,00	732.283,20	878.739,84	1.054.487,81	3.629.683,73
Impacto sobre P&L OPFH	173.429,07 €	299.015,64 €	578.503,73 €	694.204,47 €	833.045,37 €	2.578.198,28 €
Incremento Fact OPFH Agrosingularity	0,50%	0,52%	1,00%	0,75%	0,72%	0,72%
Nuevos empleos en exclusión social creados	17,38	29,97	57,98	69,57	83,48	258,38

Source: Daniel Andreu, CEO - Agrosingularity

5.1 Economic

The increase in sales, due to the growing demand in transformation of non-valued fruits and vegetables into ingredients, and consumer trends, generate business development and somehow supports the 2030 Sustainable Development Goals established by the United Nation; SDG No. 1; End poverty in all its forms everywhere to eradicate, and SGD No. 2; End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

As per the Figure No. 6: What percentage of non-commercialized food goes to consumers (C) and industry (I) - Unic Response - being 334 companies the total sample; 166 companies stated that NONE of that food goes to the industry for transformation.

Therefore, if only 5 % (8 industrial / process companies) out of the 166 companies could use non-commercialized food (fruits and vegetables) and having the average of sales in Kg of Agrosingularity as variable; the increase of sold ingredient in KG could be amazing, bearing in mind that this could bring more people to be employed and definitely supports the environment and sustainability. The recovered and sold ingredients could pass from 1,3 Million to 5,5 million kg accumulated, from 2020 until 2024.

Table 12. Hypothetical projection of 9 companies - Ingredients sold in KG

Activity	2020	2021	2022	2023	2024	Total
Sold KG Agrosingularity	77,524.80	113,523.20	280,402.40	367,327.20	539,971.20	1,378,748.80
8 processing companies	38,762.40	56,761.60	140,201.20	183,663.60	269,985.60	689,374.40
			x 8			5,514,995.20
Amount of kg (ingredients) that could be processed and sold by 9 companies						6,893,744.00

Reference: Self-made out of Agrosingularity business chart, 2021

5.2 Social

If there is increase in sales, there will be higher employability. Sustainability and recovery resources goes along social responsibility, and therefore, creation of direct and indirect job positions within this concept and the industry.

According to data from the Labor Force Survey (EPA) and diagnosed by the National Institute of Statistics (INE), at the end of 2019 there were a total of 906,925 active people within the primary sector (agriculture, livestock, hunting, forestry and fishing)

In the food and beverage industry the number of employed persons at the end of 2019 (data from the EPA for the fourth quarter) amounted to 462,300 people, 4.2% more than in the same period of the previous year, 2018.

The following table estates a 4 year projection about creation of new jobs (direct and indirect) until 2024 according to the business chart provided by Agrosingularity. Based on these values, a hypothetical projection has been developed if 9 companies follow the resource recovery business model of transforming non-valued products into ingredients to a final product. Although there are industries that generate many more jobs, this trend is rising, and the most important thing is that one of its main objectives is to employ people who are socially excluded or do not have easy access to decent jobs. Similar to the economic impact, the social focuses on improving SDG No. 1 and 2.

The sub-total of jobs (direct and indirect) created by Agrosingularity (as per their business chart) is 298 people, however, if 8 companies of those involved in food transformation use this concept, by production volume, they could employ, together, a total of 2685 people, ascendingly from 2020 to 2024.

Table 13. Hypothetical amount of new jobs created based on the business model

Activity	2020	2021	2022	2023	2024	Total
Indirect jobs created by Agrosingularity	23	23	28	30	40	40
New jobs in social exclusion created	17.38	29.97	57.98	69.57	83.48	258.38
Sub Total Jobs created by Agrosingularity						298.38
Amount of new jobs created (direct and indirect) if 9 companies follow the business model						2,685.42

Source: Self-made out of Agrosingularity business chart, 2021

5.3 Environmental

The most important environmental factors to evaluate are the number of tons of non-valued fruits and vegetables that could be recovered, as well as the reduction in the emission of greenhouse gases. The environmental impact that arises from a sustainable food business model or concept goes beyond the excellent reputation of the company towards society, and in effect with real data it consciously seeks to support SDG No. 12, Ensure sustainable consumption and production patterns.

In the following table, there is a projection recovered food in tons over time and its rapid growth in volume. Starting the year 2020 with 588 recovered tons, until 2024 with encouraging numbers in food recovery that reach 4,000 tons, while the total value - over the years - are 10,000 tons of food recovery.

On the other hand, we can observe the increase in non-emitted greenhouse gases in tons by the Spanish Agrosingularity over the years; even though growth of production and sales, they have managed to decrease greenhouse gasses and have become environmentally friendly company while recovering non-valued into final fruits and vegetables ingredients.

The following table contains real and hypothetical information in order to project the impact that 9 companies could generate if they proceed similar to the Spanish Agrosingularity and the high impact to the environment.

Table 14. Hypothetical amount of recovered food and not emitted greenhouse gasses

Activity	2020	2021	2022	2023	2024	Total
Recovered foods (TN) by agrosingularity	588.41	861.64	2,128.25	2,788.01	4,098.38	10,464.69
Not emitted greenhouse gasses (TN) by agrosingularity	2,471.34	3,618.89	8,938.67	11,709.66	17,213.20	43,951.76
x 8 for each activity						
Amount of recovered foods in TN						83,717.52
Amount of Not emitted greenhouse gasses in TN						351,614.08

Source: Self-made out of Agrosingularity business chart, 2021

6. CONCLUSIONS AND RECOMMENDATIONS

The methodology used and the development of a food waste, cause and effect, Ishikawa Fish bone model has support to identify and understand the root cause of the problem of wasting fruits and vegetables while harvesting. Instead of transforming, in Spain - with regards Fruits, vegetables and critics, producers (farmers) stated over the Spanish Barometer that due to lack of commercialization; 3.74 % of the interviewed waste between 1 - 10 %, 0.39 % waste between 11 – 20 %, and 0.76 % waste more than 20 %. Out of the 28 million of tons produced in Spain within the fruits, vegetables and critics industry; 11 million tons (aprox) are wasted.

The main / root causes found while designing the Ishikawa Fish Bone model are: Production Efficiencies & Forecasting Error, Quality and harvesting control, Storage, transport & Handling,

Weather & Major events, Customer preference, Training and Materials. Those factors and its direct link while harvesting are the main cause of waste.

If producers take into account, or develop its own cause and effect, Ishikawa Fish bone model, would be of great support to tackle waste, become more productive and engage within new trends that support the environment and the development of firms.

Additionally, if there is a conversion in the set of mind of the Spanish producers / farmers that throw wastage - food - away (51.5 %) and the 3 % that destroyed it; to the initiative of 35 % that actually recycle or reuse, would be as of great impact to the environment by reduction of greenhouse emissions, but also to fulfill and empower circular economy.

Circular agriculture should become a support base of the economy, rather than a subsidized sector, ensuring economic sustainability, safeguard the preservation of biodiversity and productivity over time in its agroecosystems, ensuring environmental sustainability and generally contribute to providing food security, eradicating poverty, and improving health and living conditions, or social sustainability.

The intention is to reduce the waste of fruits and vegetables by proposing to use non-valued foods to transform them into ingredients, this being the main value proposition of a winning business model: Which generates economic resources for companies, but it also contributes to the sustainable development goals. In addition, it promotes a circular culture which aims to return to the earth what has provided, after using or consuming it.

The proposed Resource Recovery Business model, suggest actions that could be applied within the agricultural, fruits and vegetables, industry with the aim to transform waste to powdered ingredient for developing new products

If the fruits and vegetables produced by farmers do not meet the standards imposed by supermarkets and customers by being asymmetric or not perfect, one of the key activities developed on the Resource Recovery Business model is to create an strategy to re-use it and create powdered ingredients considering those unshaped fruits or vegetables have same nutrients as products that comply with supermarket's regulations.

The Key partners to fulfill the business model by developing knowledge are the local governments to acquire training in reverse logistics and waste management, funds and even a strategic public-private alliances to develop joint projects whose main objective could be to reduce food waste by joining forces to develop end products based on non-valued raw materials.

A processing plant and the equipment needed to transform raw products into final ingredients has become an investment challenge for producers, however, those are key resources that need to be place into a strategic plan; some multinational companies are betting on placing its own processing plant, while others have outsourced the service to a key partner.

Value proposition is a key factor for success, therefore and considering actual trends, companies should focused on sustainability to address environment issues, implement strategies to recover

products and produce (transform) low cost - high value – products, from raw to powdered ingredients.

The main customer for non-valued fruits and vegetables are the companies that transform raw material into ingredients using spray dry technology for the production of final products. At the moment, a large percentage, of food is wasted because of its shape or lack of cosmetic that does not comply with the high standards of many supermarkets / distributors. Several companies, especially multinationals and other innovative ventures, have seen waste as an opportunity and have become main customers for farmers who have the need and willingness to generate economic resources through food waste.

Another client could be the same company, through the creation of a subsidiary that is in charge of buying / transforming and then selling, having created a different option. Bearing in mind that is important to maintain an independent fully closed commercial loop with the intention of not affecting the main fruit and vegetable market business, but with the purpose of innovating, growing, contributing to the environment and diversifying its production.

The channel to develop is towards food processors that use spray dry, whose objective is to use the raw material to create new recipes based on healthy ingredients. Now a days there is market for recovered products, and soon it would become necessary to convert waste (food), considering there is a big shortfall between the amounts of food we produce today and the amount needed to feed everyone in 2050. There will be nearly 10 billion people on Earth by 2050 - about 3 billion more mouths to feed than there were in 2010.

Under this model, waste creates value and enhances agriculture in general, taking into account that trends point to reusing raw materials. By doing this, it will be possible to reduce food waste and promote sustainable products that follow the principal of converting with the aim of supporting those in need, as the main choice, but also serve to produce high-level nutritive products that can be promoted on the shelves of supermarkets.

While analyzing the surveys, the majority of the responses (94 out of 104) agreed with 47.1 % and strongly agreed with 43.3 %, concluding that farmers should you use or implement circular economy business model.

Also, people are very into new consumer trends, like Airbnb farming, to prevent farmers from wasting. There is a clear message that people is much more into initiatives that could support farmers, waste and mutual development and support, having 92 people out of the sample (104) saying that they agree (51.9 %) and strongly agree (36. 5 %) immersing themselves in new trends, like purchasing products that have used non valued fruits and vegetables, also Airbnb Farming, which was created to Co-investing (Purchase) in the production of a tree (e.g. oranges) for determined period and have it delivered at your doorstep. This initiative began due to low prices paid by supermarkets and other intermediaries to small farmers (Making almost impossible for living). On top of that, part of the harvest would always go to waste because they couldn't sell it.

The written interviews to a professionals that end up as study case have enrich the theory and potential of transforming non valued fruits and vegetables into ingredient, and the most relevant

insights are: Circular or Upcycled economy model not only has the capacity to value and contribute to a positive impact on the environment, but by taking advantage of these losses, companies are able to use active ingredients to produce new, more functional and nutritious foods, fighting deficits as important as protein, dietary fiber or intake of vitamins and minerals

On the other hand, the increase in sales (Case Study), due to the growing demand in transformation of non-valued fruits and vegetables into ingredients, and consumer trends, generate business development and somehow supports the 2030 Sustainable Development Goals established by the United Nation; SDG No. 1; End poverty in all its forms everywhere, and SGD No. 2; End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

If there is increase in sales, there will be higher employability. Sustainability and recovery resources goes along social responsibility, and therefore, creation of direct and indirect job positions within this concept and the industry.

According to SDG, there are real shocking facts of what is happening around the globe, the most relevant are: Plus 71 million people are pushed into extreme poverty in 2020; 26.4 % of people are affected by food insecurity; the world continues to use natural resources unsustainably - 85.9 billion tons of global material (food print in 2017) and 13.8 % of food is lost in supply chains.

While analyzing the interviews, the vast majority agreed (44.2 %) and strongly agreed (47.1 %) that responsible consumption and production could guarantee sustainable consumption and production. This align with SDG No. 12 and the 2030 agenda.

To finalize, in order to evaluate economic, environmental and social impact of transforming non valued fruits and vegetables into ingredients, an analysis (Using Case Study) of a company performing upcycling tasks has been studied, mainly to identify its turnover, reduction of GHG and improvement of workforce, having as a result that: If 9 companies, follows Agrosingularity upcycle tasks, in 4 years there could be almost 7 million Kg of ingredients sold that have been processed out of non-valued fruits and vegetables. Additionally, if 9 companies follow the business model; 2,685 direct and indirect jobs (including social exclusion) could be created in 4 years aiming SDG 1 & 2, and finally 9 companies could recovered 83, 717(TN) which is 8 times more than the actual recovered of foods by Agrosingularity and the amount of non-emitted gases could rise from 43,951 to 351,614 (TN) having a big impact on the SDG 12.

7. INNOVATION: FURTHER RESEARCH

The development of non-valued food products is a topic that deserves research in several areas, especially economic, social and environmental. After investigating and deeply learning the consequences of food waste, the root cause and the viability of developing a business based on this sustainable concept, in the future, as part of a sustained investigation with a multidisciplinary team, I would like to develop a product using a Resource Recovery business model with the intention of contributing to the noble cause of improving the environment and eliminating part of food waste, creating a product with high differentiating value and promoting sustainability based on Circular Economy. In the next section, examples of transformation of non-valued foods into Nobel products.

7.1 New products

The world is full of creators, creative people who want to generate differentiating products, and there are also revolutionaries who go beyond what is imaginable, to create products based on non-valued food - raw material - and transform it into a sustainable good.

This thesis has allowed me to analyze products from another point of view, I will continue investigating new entrepreneurs and sustainable innovative ideas with great environmental and social value.

Bellow two incredible examples, non-valued (otherwise waste) to final good.

The company Fruitleather Rotterdam have developed a process that converts left-over fruit into leather-like material. As per the website, “The Company was first founded in 2016, our main goal was to find a new use for the large amount of fruit waste. Situated near the port of Rotterdam, large amounts of fruits being imported will never find its way to the consumer. We believe this could change from now on, as it can be transformed into a durable leather-like material suitable for different applications”.

Specifically, they are using non valued Mangoes that reach the Rotterdam Port and can't be commercialized, to create leather products. Their philosophy goes along with this thesis; fruit waste as a residue but as a valuable starting material.

Fruitleather Rotterdam has created the product to solve both industries (fruits / leather) problems, “The two worlds of fruit and leather are combined where the waste of the fruit industry is used to radically change the world of the polluting leather industry.”

Figure 23. Transformation: Fruit to leather



Reference: Fruit Leather Rotterdam, 2021

On the other hand, there is a very ingenious product denominated, Eggo Bricks. Scientists Create Real Building Materials from Food Leftovers. Researchers in Japan have created a concrete replacement out of food scraps — and the new compound can be both edible and sweet-smelling (Laffan, 2021).

Figure 24. Building materials out of food leftovers



Reference: Grainger Laffan, Zenger news, 2021

New ideas are replacing, little by little - current products, such is the case of bricks made out of nonvalue food with exceptional functionalities like bending strength higher than that of concrete. (Machida, K.; Sakai, Y 2020). Even though, those crazy ideas would take long time and a lot of resources to generate a real impact on the environment and waste, it is satisfactory learn that people is seeking to protect the globe with high end products.

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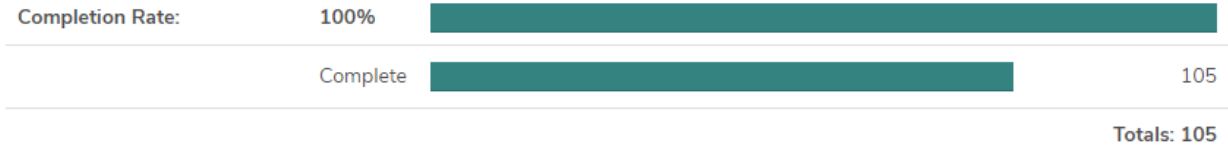
9. APPENDIX

End user qualitative survey – Trends & acceptance

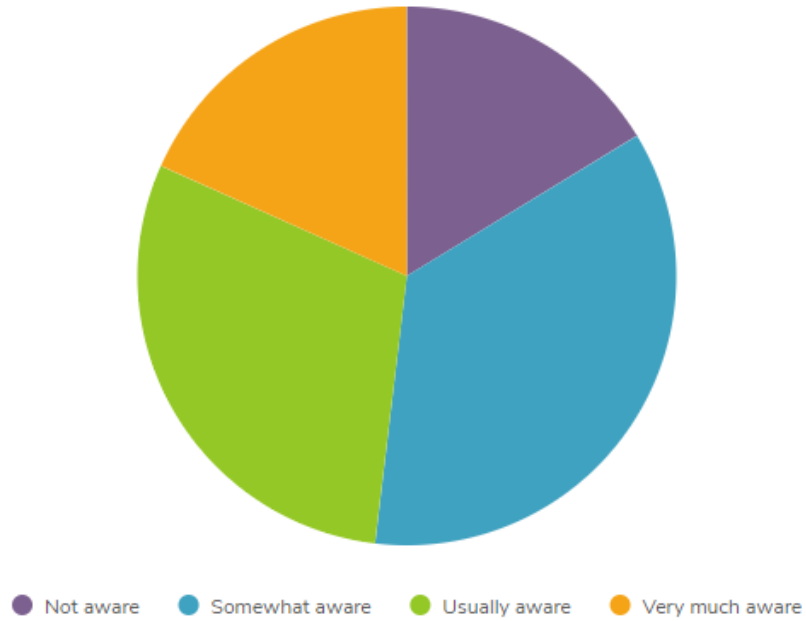
Report for End user Survey - Converting non-valued fruits and vegetables into raw materials and powdered ingredients

May 26, 2021

Response Counts



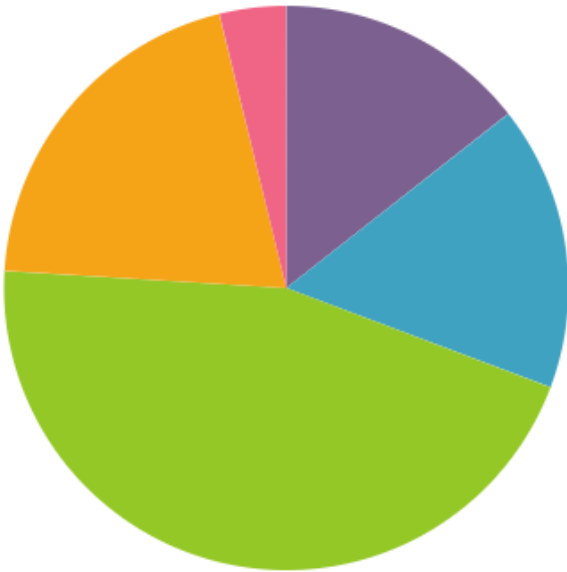
1. Are you aware that, roughly one - third of the edible parts of food produced for human consumption, gets lost or wasted globally, which is about 1.3 billion ton per year?



Value	Percent	Responses
Not aware	16.3%	17
Somewhat aware	35.6%	37
Usually aware	29.8%	31
Very much aware	18.3%	19

Totals: 104

2. Would you buy a product from the one - third of the edible parts of food produced that is wasted?



● Hardly ever ● Occasionally ● Sometimes ● Frequently ● Almost always

Value	Percent	Responses
Hardly ever	14.4%	15
Occasionally	16.3%	17
Sometimes	45.2%	47
Frequently	20.2%	21
Almost always	3.8%	4

Totals: 104

3. Would you buy a product manufactured from this one - third that is wasted, considering that it cannot be sold because of its shape or size?

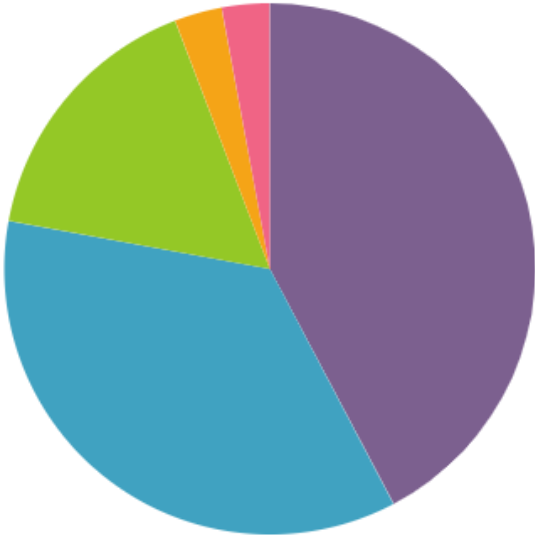


● Hardly ever ● Occasionally ● Sometimes ● Frequently ● Almost always

Value	Percent	Responses
Hardly ever	7.8%	8
Occasionally	19.4%	20
Sometimes	39.8%	41
Frequently	21.4%	22
Almost always	11.7%	12

Totals: 103

4. Do you agree that imperfect fruits or vegetables (Lack of cosmetics) possess same amount of nutrients as perfect shaped fruits or vegetables? Imperfect Foods: cosmetic damage, undervalued or lack of demand, or doesn't meet a strict specification from the buyer, usually in the way it's harvested.

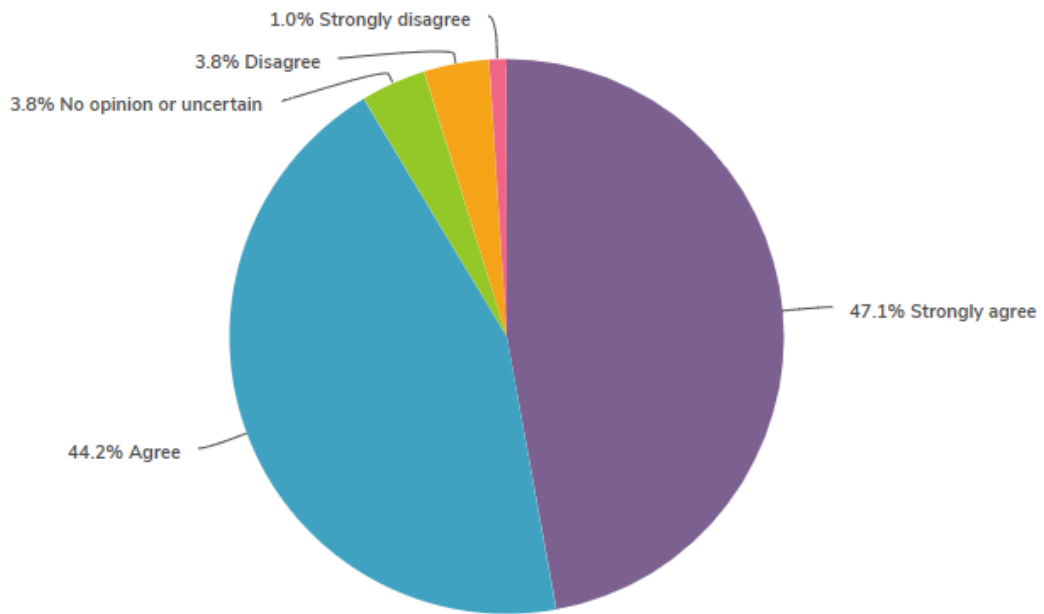


● Strongly agree
 ● Agree
 ● No opinion or uncertain
 ● Disagree
 ● Strongly disagree

Value	Percent	Responses
Strongly agree	42.3%	44
Agree	35.6%	37
No opinion or uncertain	16.3%	17
Disagree	2.9%	3
Strongly disagree	2.9%	3

Totals: 104

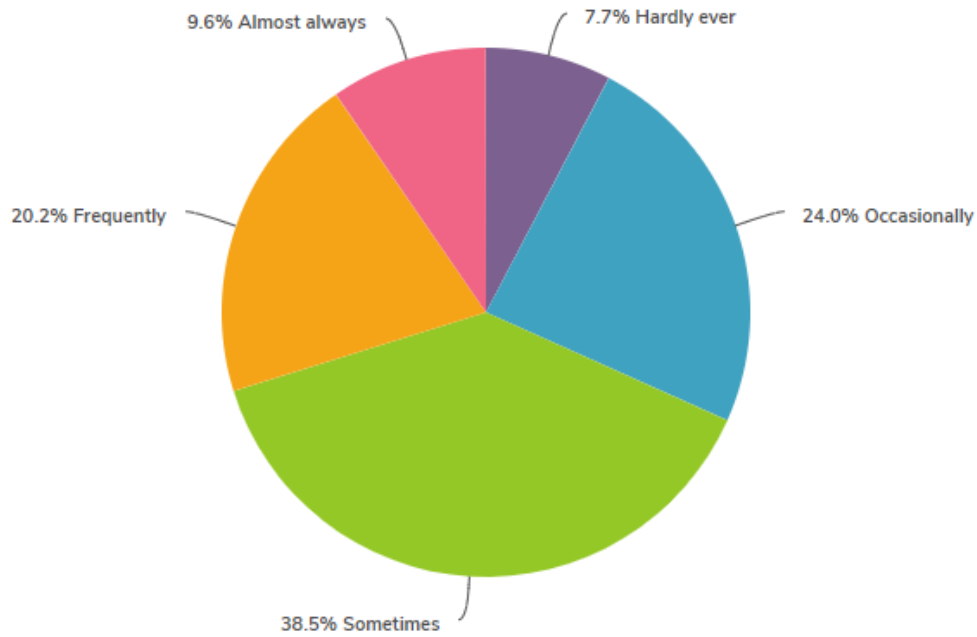
5. Do you agree that responsible consumption and production guarantee sustainable consumption and production patterns?



Value	Percent	Responses
Strongly agree	47.1%	49
Agree	44.2%	46
No opinion or uncertain	3.8%	4
Disagree	3.8%	4
Strongly disagree	1.0%	1

Totals: 104

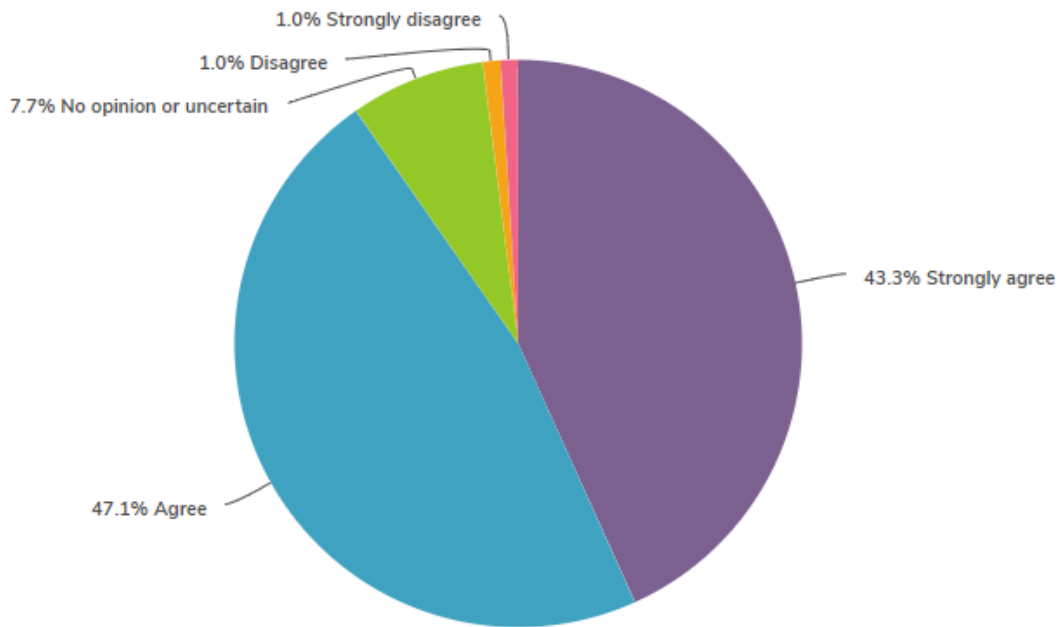
6. Are you looking for products that, among other indicators, place on its packaging the following labels: Fair Trade, 100% natural ingredients, Ecological, Organic, Circular economy?








Value	Percent	Responses
Hardly ever	7.7%	8
Occasionally	24.0%	25
Sometimes	38.5%	40
Frequently	20.2%	21
Almost always	9.6%	10

Totals: 104

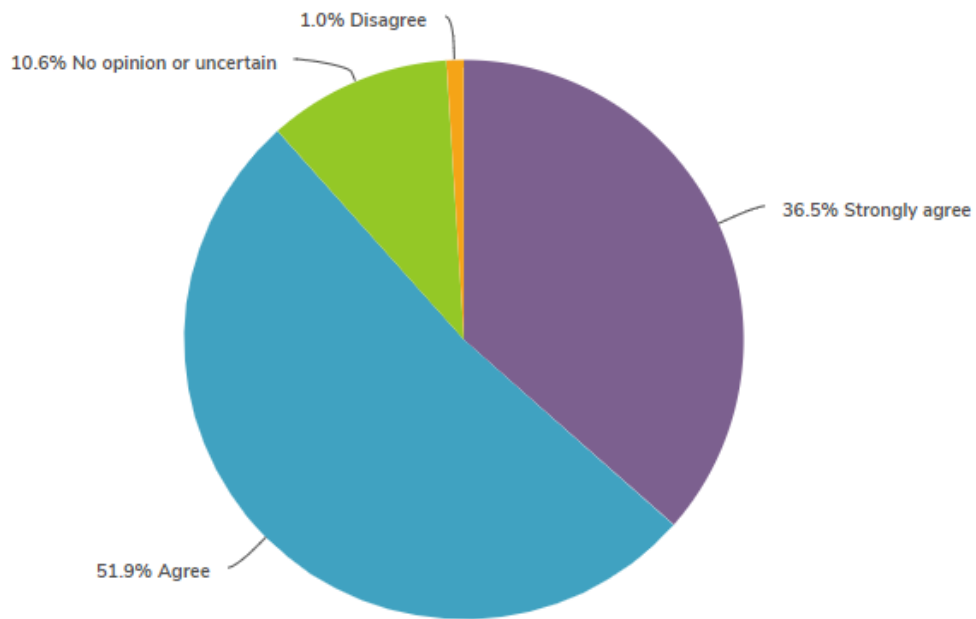
7. Do you think that the Circular Economy business model should be used by fruit and vegetable farmers? A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.



Value		Percent	Responses
Strongly agree		43.3%	45
Agree		47.1%	49
No opinion or uncertain		7.7%	8
Disagree		1.0%	1
Strongly disagree		1.0%	1

Totals: 104

8. Would you get involved in new consumer trends, like Airbnb farming, to prevent farmers from wasting? Airbnb farming: Co-investing (Purchase) in the production of a tree (e.g. oranges) for determined period and have it delivered at your doorstep. This initiative began due to low prices paid by supermarkets and other intermediaries to small farmers (Making almost impossible for living). On top of that, part of the harvest would always go to waste because they couldn't sell it.



Value	Percent	Responses
Strongly agree	36.5%	38
Agree	51.9%	54
No opinion or uncertain	10.6%	11
Disagree	1.0%	1

Totals: 104

Producers interview – Raw material to final product

1. Agrosingularity / Daniel Andreu – CEO

Daniel Andreu

Mon, Jul 12, 6:07 PM (2 days ago)

to me

Hola Christian, perdona la tardanza, pero no he encontrado un hueco de calidad para poder contestarte, lo hago en Castellano que es más rápido.

Environment Aspect

Do you agree or believe that a Circular Economy Business Model could reduce waste of fruits and vegetables and launch a positive habit of reuse raw materials to convert them into ingredients?

Totalmente de acuerdo, el modelo de economía circular o Upcycled no sólo tiene capacidad de valorizar y contribuir al impacto positivo en el medio ambiente, sino que aprovechando estas mermas somos capaces de aislar principios activos / principios activos para producir nuevos alimentos más funcionales y nutritivos, combatiendo déficits tan importantes como la proteína, fibra dietética o ingesta de vitaminas y minerales.

How viable is it to access non-valued fruits and vegetables?

Actualmente está considerado como una merma estructural, en el sector primario (agricultura), una media del 7% anual se pierde y en el sector agroindustrial (zumos, conservas, manipuladoras), alrededor del 40% del producto original es descartado por procesos de fabricación, actualmente en España esto suma unas 3.3M de TN/año

Social Aspect

Do you believe manufacturers could hire more staff to transform raw material into ingredients?

No es una cuestión de mayor contratación sino de alargar la cadena de producción, contribuyendo a más horas contratadas del personal actual, siendo el 90% Hombres en Agricultura y 90% Mujeres en conserva, tiene un impacto positivo en el mantenimiento y dignificación del trabajo.

Has your company (or stakeholders) increased harvesting staff for this purpose?

Podría llegar a darse el caso, adjunto un cuadro que realizamos de cómo una empresa realizando tareas de upcycling podría aumentar su facturación y mejorar la fuerza laboral.

Commercial and Economic Aspect

How viable is it to transform non-valued fruits and vegetables into a new trend product?

El gran "reto" es la logística, clave para que los unit economics puedan ser viables en la creación de este nuevo modelo de negocio, otro aspecto a considerar es el "cost of processing" ya que al ser un negocio de volumen, estos costes son los que a final de año te permiten tener una EBITDA positivo.

Would you implement the process of transformation if profitable for your firm?

Of Course :)

Año	2020	2021	2022	2023	2024	Total Acumulado
Facturación Agrosingularity						
kg Vendidos Agrosingularity (Kg)	77.524,80	113.523,20	200.402,40	367.327,20	539.971,20	1.378.748,80
Alimentos recuperados Agrosingularity (Tn)	588,41	861,64	2.128,25	2.788,01	4.098,38	10.464,70
G.E.I no emilidos Agrosingularity (Tn)	2.471,34	3.618,89	8.938,67	11.709,66	17.213,20	43.951,76
Puestos de Trabajo Indirectos Agrosingularity	23	23	28	30	40	40,00
Colaboradoras OPFH Agrosingularity	3	5	5	8	10	10,00
Media Trabajadores OPFH	348,00	580,00	580,00	528,00	1.160,00	1.160,00
Facturación Media OPFH Colaboradoras	34.725.000,00 €	57.875.000,00 €	57.875.000,00 €	92.600.000,00 €	115.750.000,00 €	358.825.000,00 €
Impacto sobre OPFH (kg)	353.936,88	610.236,00	732.283,20	878.739,84	1.054.487,81	3.629.683,73
Impacto sobre P&L OPFH	173.429,07 €	299.015,64 €	578.503,73 €	684.204,47 €	833.045,37 €	2.578.198,28 €
Incremento Fact OPFH Agrosingularity	0,50%	0,52%	1,00%	0,75%	0,72%	0,72%
Nuevos empleos en exclusión social creados	17,38	29,97	57,98	69,57	83,48	258,38

Daniel Andreu

CEO

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www.agrosingularity.com

2. Diana Foods / Santiago Yanez – Global Product Manager

Santiago Yanez

to me ▾

Wed, Jun 9, 10:41 PM ☆ ↶ ⋮

Hola Chris

Espero te encuentres bien. Un gusto seguir en contacto. Te envío mis respuestas

Environment Aspect

Do you agree or believe that a Circular Economy Business Model could reduce waste of fruits and vegetables and launch a positive habit of reuse raw materials to convert them into ingredients?

How viable is it to access non-valued fruits and vegetables?

SY:

Yes, I totally agree that a circular economy model could reduce the waste of fruits and vegetables and for instance transform them into ingredients.

For the viability, first it will depend in different variables.

For example, in the case of Ecuador, Diana Food-Part of Symrise, produces banana pure and dried products and we have around 30,000 ton/year of banana peel(now as waste) that we are trying to sell it as Banana peel powder as an ingredient.

Social Aspect

Do you believe manufacturers could hire more staff to transform raw material into ingredients?

This will depend on the business model of each company.

Has your company (or stakeholders) increased harvesting staff for this purpose?

No. Because we still haven't been able to sell all the 30,000 ton of banana peel as an ingredient. If do it, then there will be for sure an increase of staff at the factory.

Commercial and Economic Aspect

How viable is it to transform non-valued fruits and vegetables into a new trend product?

It is possible thanks to different technologies.

Would you implement the process of transformation if profitable for your firm?

We are doing it.

Espero haya ayudado. En caso necesites más detalles me timbras por WhatsApp y lo seguimos hablando

Un abrazo

Santiago Yáñez

3. Dlip Industrial / Catalina Polanco – International Business Development Manager

Catalina Polanco
to me ▾

Jul 20, 2021, 10:30 PM (12 hours ago) ☆ ↶ ⋮

There is a big volume of waste from fruits and vegetables, they should be reused as ingredients. For this, transformation and recovery industries are required of the important elements that within the circular economy model generate ingredients with high added value.

Definitely when creating new industries there would be greater job opportunities. At this moment the culture of the value of fruits and vegetables waste is not enough, we must understand that maintains an important contribution of vitamins and minerals.

Possibly, 70% of household waste is organic waste, so it would be important to transform it into resources. In addition, it reduces methane, a toxic gas and reverses climate change.

Possibly, 70% of household waste is organic waste, so it would be important to transform it into resources. In addition, it reduces methane, a toxic gas and reverses climate change.

From my point of view it is viable, it is important to take advantage of the complete life cycle of food; In addition to replicating the way that nature has to treat waste and convert it into beneficial and regenerative products, with great social, economic and environmental benefits.