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Partnerships for Sustainable International Business: The case of a family business

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This study consists of three reports aiming to understand how a Portuguese family-owned coffee company, Delta Cafés, incorporated sustainability into the core of its strategy in the interest of closing the cycle of coffee grounds. A survey and benchmarking have been conducted in order to enrich the analysis. The reports also seek to analyze the business partnership between Delta Cafés and Nãm, a sustainable startup turning spent coffee grounds into mushrooms.

Keyword: Sustainability, Social Impact, Circular Economy, Delta Cafés, Portugal

Text

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CASE-STUDY

“Closing the cycle of coffee grounds: a persisting challenge for Delta Cafés”

In February 2019, Rui Miguel Nabeiro, CEO of the Portuguese coffee brand Delta Cafés, was presented with a potential answer to a matter the company had been trying to solve for years: the reuse of its spent coffee grounds – “the waste product that remains in a pot after brewing coffee” (NAL Agricultural Thesaurus and Glossary n.d.) – through a profitable business venture. When Natan Jacquemin shared with the CEO the business model of his start-up, NÃM, the 24-year-old Belgian entrepreneur explained that he had been collecting spent coffee grounds from local cafes and restaurants, and reusing them as substrate to produce delicious, fresh Oyster mushrooms in a very small-scale urban farm in Largo do Intendente, in Lisbon. This quality product was then sold to restaurants and cafes in its proximity, to ensure the mushrooms’ distinctive freshness that allured clients. In this way, spent coffee grounds, held by many as mere waste, were revalued and reintroduced into the economy.

In earlier years, Delta Cafés had attained a strong awareness and sense of duty to minimize its coffee grounds waste, and the environmental impact it implied. After all, in coffee production and consumption activities, only 1% of coffee's biomass was actually used, with the remaining 99% being discarded as waste and left to rot in landfills, emitting large amounts of CO₂ and methane, well-known contributors to global warming (Kaffe Bueno n.d.). With the company producing such large amounts of coffee, which resulted in the double of that in spent coffee grounds (Delta Cafés 2011), it was clear something had to be done. But, despite extensive research throughout the years on the potential of spent coffee grounds’ components, no economically viable possibilities had been found until then.

Natan Jacquemin was looking for investors to grow his business, and Delta Cafés, with its strong presence in the coffee sector and reputation as a social and environmentally conscious brand, seemed an obvious entity to partner with. NÃM built, by all accounts, a very creative

circular economy venture, to which Delta Cafés could contribute by supplying its spent coffee grounds while simultaneously reducing the company's coffee waste. However, when considering a potential partnership with NÂM, Rui Miguel Nabeiro had to consider the issues that could arise. Among other challenges, the start-up handled small quantities, and for its impact to be truly relevant, its scale-up needed to be possible. This was not certain, as it required Delta Cafés to make available specific reverse logistics – “all supply chain and logistics operations relating to the reuse and recyclability of products and materials” (Machl 2017) – for coffee waste collection that would ensure the freshness of the spent coffee grounds, vital for the production of NÂM's mushrooms. Moreover, the CEO knew that this type of logistics was typically inefficient and costly, consequently reducing products' value.

A family company deeply rooted on social responsibility

To fully comprehend the values that accompanied Grupo Nabeiro throughout the years, and which its CEO and board still uphold when making strategic decisions, it is important to look back into its roots. Delta Cafés was founded in 1961 by Rui Miguel Nabeiro's grandfather, Rui Nabeiro, in his small hometown of Campo Maior, Alentejo (Delta Cafés n.d.). Ever a man of vision, the then 30-year-old entrepreneur of humble beginnings decided to start his own coffee roasting business, after having worked in his family's coffee roasting plant for 17 years (Swiatkiewicz 2017). Starting with as little as 3 employees and 2 ovens in a small 50 m² warehouse (Swiatkiewicz 2017), the company's growth did not come easily in the first years. Nonetheless, with his entrepreneurial mindset and drive to succeed, the business eventually began to thrive.

Throughout time, the eagerness to grow the company never wavered, and Delta Cafés always made active efforts to embrace technological progress, innovate and create new products to meet emerging consumer preferences. The need to diversify the business was also recognized, which is why after a company restructuring in 1998, establishing Grupo Nabeiro

as the parent entity to Delta Cafés, new companies were created: Grupo Nabeiro started to include 22 firms in the areas of food and beverages, property, industry and services, distribution, as well as tourism and catering (Grupo Nabeiro n.d.).

Delta Cafés grew to become one of the most trusted Portuguese brands, having secured its position as market leader in Portugal since 1994 (Grupo Nabeiro n.d.). Although its business activities were most prevalent nationally, the company expanded abroad, being present in 40 countries and directly operating in 8 (Grupo Nabeiro n.d.). In 2020, it reached 400 million euros in sales, recording more than 22 600 tons of coffee sold (Grupo Nabeiro n.d.).

“A brand with a human face”

Since its beginning, Delta Cafés stood out among other Portuguese coffee brands due to Rui Nabeiro’s human management philosophy. His commercial relations followed the rationale that “each customer is a friend”, handling each case as unique, and relying on proximity and transparency to build authentic relationships with clients and boost loyalty (Delta Cafés n.d.).

The founder’s concerns over socio-economic inequalities were also consistently brought to his business endeavors. This was witnessed through Delta Cafés’ initiatives for the community of Campo Maior, where the company had its origins, as well as for coffee producing communities (Grupo Nabeiro n.d.). Furthermore, in adaptation to the growing awareness on environmental issues, it made efforts in its operational efficiency, namely in the Nova Delta factory, with first actions on reducing and optimizing water and energy consumption (Delta Cafés 2004).

Throughout its years of activity, Delta Cafés, and subsequently Grupo Nabeiro, became widely held as a strong example of Corporate Social Responsibility in Portugal. Rui Nabeiro’s commitment to the brand’s core values (including integrity, transparency, truth, quality, solidarity, sustainability, humbleness, innovation and loyalty) built a “brand with a human face”

(Grupo Nabeiro n.d.) and nurtured a socially aware company culture that heavily influenced his children and grandchildren, to whose care he left his legacy; in particular his grandson Rui Miguel Nabeiro, when he became the CEO of Delta Cafés. And as he took on the leadership of the reputable company, he took on its challenge “to meet the expectations of our consumers, ensuring complete customer satisfaction through a business model that is based on the creation and sharing of sustainable value. Management with a human face is an important commitment, and to meet it we will face the future with responsibility and respect for the next generations” (Grupo Nabeiro n.d.).

Unsustainable new consumer preferences shed light on the industry’s environmental impact

Delta Cafés’ decision to move into the single-use capsules market

During the 1990s and 2000s, the coffee industry was facing new market trends and a strong international competitor, Nestlé’s Nespresso. Its innovative capsules system, first introduced in the household market in 1989 (Nestlé Nespresso n.d.), went through significant technological evolution and market expansion in the following years, with patents’ protection blocking “the appearance of new concepts for a long time” (Lusa 2007). Nespresso finally expanded to Portugal, and “when the first (...) store opened in Chiado, Lisbon, in 2003, the Portuguese euphoria was witnessed through never ending queues that filled Rua Garret for weeks” (Nogueira 2013). With such an entry by Nespresso, the single-use capsule market in Portugal was emerging and Delta Cafés had to guarantee its share of it. Matching the worldwide fast-growing competitor was vital, to respond to the innumerable client requests of such a product from the brand and secure its lifetime relevance in the Portuguese market. Otherwise, the company could see its revenues from coffee for general home consumption fall significantly.

Rui Miguel Nabeiro found that “The Portuguese wanted a mature, aware, and experienced supply, through Delta. The innovation and attention to customers’ needs, as well as of the emerging markets, and the bet on coffee distribution through capsules to the consumer” (Delta Cafés 2007) led to the creation of Delta Q. After first unsuccessful attempts, extensive market research and careful analysis of the competitors’ products, the company was finally able to develop its own “innovative system for capsules to be used in coffee expresso machines exclusively designed for Delta” (Delta Cafés 2007). In October 2007, Delta Q capsules, blends and machines were on the market, and five years after, in 2012, Delta Q reached market leadership, with 500 000 machines and 325 million capsules sold (Monteiro 2018).

A concerned, but proactive vision on sustainability challenges ahead shapes Delta Q

Single-use capsules had conquered home consumption, and as they flooded the market and took a substantial role in consumers’ coffee-drinking habits, industry players could not deny the major sustainability challenges to be faced. These products had come to stay, and while pressure regarding these issues was slight within the Portuguese market, environmental issues swiftly began being stressed internationally.

For Rui Miguel Nabeiro, the values and culture with which his grandfather had founded the company weighted heavily on strategic decisions, and the need to follow the market trend to maintain Delta Cafés’ competitiveness did not blind him to the looming waste that this implied. There was a belief that the brand had a duty to shape conscious behaviors, and steer consumers into holding sustainability principles as increasingly important factors into their purchasing choices (Delta Cafés n.d.). In addition, growing concerns over the amounts of residues that these products generated could be foreseen, as well as a demand for sustainable business models which would eventually be reflected on future consumer preferences.

Therefore, since its earliest stages of development, Delta Q was shaped respecting Rui Miguel Nabeiro’s vision: the brand should have its own recyclable capsules, high-quality

blends, and efficient home coffee machines, but also an integrated logistic system that would assure proper collection, recycling and reusing of the capsules sold. Yet, a key issue was left unsolved: how to manage the waste recovered from capsules, in a way that would allow its materials to be revalued and reincorporated into the economy.

At this point, the need for the circularity of materials was placed in the center of discussion. And even though solutions were not immediately found as Delta Q was introduced in the market, mapping the footprint of the company's business activities, and closing the cycle of coffee with the lowest possible impact became major priorities for Delta Cafés.

Delta Q's waste as a trigger for the commitment to close the cycle of coffee grounds

A first endeavor to pursue the circularity of materials was the “ReThink” investigation project, in place from 2009 to 2011. When it was presented to the public, Rui Miguel Nabeiro stressed that “the pleasure of drinking coffee does not have to generate waste” (Delta Cafés n.d.). In fact, the goal was to minimize the waste generated by Delta Cafés' industrial and commercial activities, particularly by Delta Q and Delta Office (which comprised products sold to companies). To achieve this, it was important to create a logistics system for the collection of the single-use capsules. Options to reuse and recycle the capsules' plastic were also assessed. After all, this residue was an obvious polluter that needed to be tackled. But as they broke apart the capsule, and separated the plastic from the dreg, they realized they could not leave half the job undone. Another intriguing matter gained unprecedented focus: the recovery and reuse of spent coffee grounds.

Indeed, less than 1% of the biomass generated by coffee production had value in the market. The other 99%, including coffee grounds, was seen as waste (Kaffe Bueno n.d.) and discarded in landfills, where it emitted significant amounts of carbon dioxide and methane, a gas 80 times more toxic than CO₂ over a 20-year period (McArthur 2021). For each ton of coffee waste decomposing in landfills, 340 m³ of methane were emitted (Kaffe Bueno n.d.).

Methane was deemed one of the major contributors to global warming, triggering climate change. This was consequently expected to affect where and how coffee could be produced in the future, “with the possibility that fewer parts of the world” would be suitable to produce coffee or may even experience negative effects in coffee productions’ quality and yield (International Trade Center 2010).

Notwithstanding this issue, for Rui Miguel Nabeiro, reusing spent coffee grounds and extending its life was always regarded as a potential business opportunity rather than only a way to tackle a problem of coffee waste. In 2010, Delta Cafés’ annual coffee production amounted to 20 000 tons, and wet spent coffee grounds potential was of double this value (Água & Ambiente 2010). With such large amounts of this residue left discarded in landfills, so much value of the coffee was being lost. Could they be recovered and channeled into economically viable business ventures, all while reducing environmental impact?

Finding answers required innovation investments and extensive investigation. Hence, the “ReThink” project was supported by the Portuguese government’s “National Strategic Reference Framework” through a financing of 2 million euros (Delta Cafés n.d.). This allowed Delta Cafés to be the first national private company to build an innovation cluster, which joined the expertise of Delta Cafés’ own R&D department and of numerous scientific and technological entities in Portugal (Delta Cafés n.d.). Together, they were tasked with carrying out research related to Delta Cafés’ logistics and, most importantly, with the study of spent coffee grounds’ components, something never done before at the European level (Delta Cafés n.d.). These partnerships were instrumental in transferring technology and knowledge to Delta Cafés, and in nurturing an innovation culture within the coffee company which valued intellectual property in its processes, products and services (Delta Cafés 2021).

The project was closed with significant achievements. An optimized logistics system was successfully developed, particularly for efficient mass collection of Delta Q capsules, and

for the recovery, reuse and recycling of its materials (Delta Cafés n.d.). Consumers' contribution to the capsules' recycling efforts was vast, confirming Rui Miguel Nabeiro's belief that consumers would have a growing awareness of environmental impact and concerns about making production cycles more sustainable (Portal Alentejano 2010).

Moreover, several technically feasible hypotheses for the recovery of coffee grounds were drafted, and possibilities were indeed found. They were deemed a great source of value-added, having components such as essential oils and antioxidants that, when extracted, could be employed into new products, namely in the areas of nutrition, agriculture, cosmetics, biomass and bioenergy (Portal Alentejano 2010). However, at the time, the economic value of spent coffee grounds was not as high as initially expected. After researching the market value for products and subproducts that could be obtained from them, and conducting an economic and financial study to assess the different valorization options, results showed that the recovery possibilities found were not economically viable, in particular due to reverse logistical constraints. Indeed, for Rui Miguel Nabeiro, logistics related to the collection of spent coffee grounds were one of the most difficult aspects, as “it is very expensive, and takes away a lot of value from the product” (Nabeiro 2021). They also implied legal issues to solve, since “you are carrying coffee waste in the same van where you are carrying food” (Nabeiro 2021). The sole economically viable exception found at the time was the compost of spent coffee grounds to produce a natural fertilizer, which could be used in the company-owned vineyards in Campo Maior (Delta Cafés n.d.).

In spite of this outcome, “ReThink” had a fundamental role. Delta Cafés was “the first Portuguese coffee brand to pursue the circularity of coffee waste” (Delta Cafés 2021), and this eagerness would remain after the project's conclusion. The willingness to find profitable possibilities for spent coffee grounds was not quashed, and as per Rui Miguel Nabeiro, Delta Cafés continued their research efforts in the years ahead, “exploring a lot of roads” and “trying

to understand where exactly an economic value was” (Nabeiro 2021). Continuing to study and refine waste management logistics would be crucial for the success of any future spent coffee grounds reusing venture. So, Delta Cafés needed to find the most efficient way to collect spent coffee grounds, convert it into a new product and make a profit out of it. Indeed, Rui Miguel Nabeiro emphasizes that “if you are not profitable, you are not sustainable” (Nabeiro 2021).

A potential solution: NÂM

One morning, in February 2019, Rui Miguel Nabeiro received an unexpected call from his friend, António Lucena de Faria, professor at Católica Lisbon School of Business and Economics. He urged Nabeiro to meet, within the next few days, one of his Entrepreneurship course’s former students who, despite having a lackluster average of 11, had a fascinating project that he believed Delta Cafés’ CEO should really know about. This student was Natan Jacquemin, a 24-year-old Belgian who was taking the first steps in his own sustainable business, a start-up named “NÂM”, which was looking for investors (Castro 2021a).

The creation of an innovative start-up

Natan Jacquemin arrived in Lisbon in 2016 to study management, but soon he became disenchanted with the reductive way of creating value taught at school, and with the prevailing system of production (Moreira and Oliveira 2018); namely the “linear economy”, an economic design “based on the sequence take (raw material), make (products), use (consume), dispose (of non-recyclable waste)” (IGI Global n.d.). In Natan’s vision, the current approach adopted by companies did not consider the environmental impact associated with the sale and production of goods (Partington 2019). As such, his concern upon finishing his studies was to find an economic model that would reconcile economy and ecology (Almeida 2018). According to Natan Jacquemin, the perfect business model would be one inspired by Nature and that, like

her, would not generate any waste, would exploit local resources, and would create numerous benefits (Partington 2019).

It was with this premise in mind that Natan undertook several internships and research in the sustainability field, through which he found a very interesting circular economy endeavor: reusing spent coffee grounds as substrate to grow mushrooms. Indeed, he learned that when a cup of coffee was prepared, only a very residual part of its biomass was used. The remainder was generally seen as useless waste, despite it being rich in nutrients and clean due to the hot water employed in the coffee's preparation (Grupo Nabeiro 2020). Hence, by utilizing this remaining coffee waste in the creation of a new product, he could revalue this "end-of-life" resource and reincorporate it into the economy. Some urban mushroom farmers in Europe had also taken on this mission, having successfully built a small business model based on this concept. Knowing this, Natan went on to visit them, to attain some expertise on how to replicate the model in Portugal. As a wiser entrepreneur with a refined idea, Natan started developing his own venture, called NÂM, in February 2018. A few months later, in August, he finally decided to invest 5000 euros in his start-up, officially founding NÂM as a limited liability company 100% owned by himself.

Natan Jacquemin built NÂM's small urban farm in a ground floor in Largo do Intendente, in Lisbon (Moreira and Oliveira 2018; Jacquemin 2019). It was here that his vision began coming to life: NÂM upcycled spent coffee grounds, collected for free from restaurants and cafes in the Lisbon area, to grow fresh organic mushrooms (see **Appendix 1** for the detailed production cycle). He later made a profit by selling and distributing this product to the same establishments, which could utilize NÂM's mushrooms in their dishes. Then, he gave any remainder from the mushrooms' production, which was rich in nutrients thanks to the mushroom growth, to nearby farmers, who employed it as organic fertilizer (Partington 2019) (see **Appendix 2** for NÂM's key activities). In this way, just like nature, the business not only

did not produce waste, but also created value at every step (Jacquemin 2019). Besides, by farming mushrooms on spent coffee grounds which were already sterilized during the coffee brewing phase, NĀM was “80% more energy efficient than traditional mushroom farming, which necessitated bacterial controls at high energy cost” (Jacquemin 2019).

As of early 2019, every month, the sustainable business was “collecting around 500 kg of coffee waste and producing 100 kg of mushrooms” (NĀM n.d.). In fact, most of NĀM’s coffee grounds suppliers barely listened to Natan’s proposal or thought twice about contributing to the business with the dregs they normally discharged. Besides, they were all visibly pleased with the partnership, eager to buy fresh gourmet mushrooms grown on their own waste and thrilled to have their brand related to a local circular economy business (Moreira and Oliveira 2018; NĀM n.d.; Jacquemin 2019). Nonetheless, the start-up, due to its small production capacity, was not financially sustainable yet (Partington 2019).

NĀM’s mission

Through his sustainable enterprise, Natan aimed at making the most of local resources while minimizing waste and its impact on the environment (Jacquemin 2019). According to NAM’s estimates, at the time, about 15 million tons of coffee grounds were wasted around the world every year, producing CO₂ and methane gas. (Jacquemin 2019). Particularly, only in Lisbon, approximately 10 thousand tons of spent coffee grounds were dumped in landfills year by year (Jacquemin 2019). In addition, as per the Food and Agriculture Organization of the United Nations, food products travelled on average 15 000 km to reach their destination (Jacquemin 2019), thus lowering their quality as goods, and generating carbon dioxide emissions as well as waste along the way (Partington 2019; Jacquemin 2019) Besides, again according to the UN Food and Agricultural Organization, “an estimated one third of all food produced globally” was lost or wasted each year (FAO n.d.) and, in Natan’s vision, much of that was attributable to the scarcity of local food offer in the cities around the globe (Partington

2019). NÂM's mission was to address these issues while fostering the sustainable development of Lisbon's local community. Besides, Natan, with his innovative start-up aimed at leading by example, showing that other ways to grow food in city areas were feasible, and that "creating value from waste" and implementing new more sustainable business models was possible (Jacquemin 2019).

The pitch of NÂM's creative circular economy business plan

At the end of February 2019, Rui Miguel Nabeiro and Lucena de Faria finally managed to have an encounter with the young entrepreneur, at Delta Cafés' headquarters in Campo Maior. It was then that, over a cup of the brand's coffee, Natan started explaining NÂM's business model, elaborating on his aspirations and goals, and sharing the plan he had envisioned for the future of the start-up.

Products and services

NÂM's appeal as a business venture was not limited to its interesting circular economy approach. This seemed clear when its products and services were detailed to Rui Miguel Nabeiro. The start-up's main product offering were Oyster mushrooms, a type of mushrooms which, according to Natan's research, was characterized by two alluring features. Firstly, "being rich in proteins, vitamins and minerals" (Jacquemin 2019), it was an item that provided health benefits to consumers. Secondly, this kind of mushrooms was a non-water intensive food product, needing merely 35 liters of water per kg in the production process, compared to the 15 400 liters demanded for the production of a kg of boneless beef (Angelopoulou 2020). Thus, these mushrooms clearly represented an efficient and water-saving production choice.

Adding to this, Natan Jacquemin deemed that NÂM's mushrooms held a significant competitive advantage over those of traditional Portuguese cultivators. The powerful story and mission of his start-up offered many opportunities to build a wide network of customers keen

on sustainable production and circular economy practices. At the time, these topics had already attained considerable curiosity and interest from consumers, frequently being placed at the center of discussions and public discourse. This trend was only expected to grow. Furthermore, as a local business, the delivery costs that NÂM could maintain gave it another leading edge. In fact, the other Portuguese mushroom farmers were all situated at least 30 km outside Lisbon (Jacquemin 2019). This distance had an impact on their delivery costs, which ranged from 8 to 15 euros per consignment, and as a result, on the prices that these farmers were able to set for their clients (Jacquemin 2019). In contrast, NÂM, being favorably close to the suppliers of its raw material, and then to its local customers, was able to collect spent coffee grounds and carry out the delivery of mushroom orders simultaneously. Consequently, Natan's start-up had the means to exclude delivery fees, allowing its clients to save up to 48 euros per month (Jacquemin 2019). Yet, according to NÂM's customers, the major distinctive and enticing feature of the start-up's mushrooms was their unmatched freshness, evidenced by their unique smell and taste. This was due to the fact that the mushrooms delivered to clients on a certain day were assured to have been harvested earlier in the morning, a luxury that competitors could not match since, on average, they only offered delivery once a week, with mushrooms being harvested 3 to 4 days before the drop-off (Jacquemin 2019).

Additionally, Natan Jacquemin knew that, for a more sustainable financial standing of NÂM, it was vital to add other revenues streams to those generated by its core business. In this regard, the young entrepreneur was aware that "Gumelo", the only Portuguese company selling mushroom growing boxes, had recently gone out of business. Since this was a product heavily related with the nature of his own company, Natan saw this recent gap in the market as a key opportunity for NÂM. As such, in addition to the fresh Oyster mushrooms, Natan was planning to sell, mainly online, two different types of home mushroom growing kits in the foreseeable future (Jacquemin 2019). The first type would be a classical "Home Grow Kit", with customers

only needing to follow watering instructions to see a portion of fully grown mushrooms in their box at home after only one week. The second type would be a “Do It Yourself Grow Kit”, through which people would be able to use their own spent coffee grounds to get Oyster mushrooms at home after 6 weeks. This latter type of box could be used multiple times, provided the customer purchased the necessary mycelium refills (mushroom seeds) and autonomously collected the amount of coffee grounds required in the instructions of use. Finally, a marginal product of this circular economy business was fertilizer. At the time, NÂM mainly gave it for free to nearby urban farmers. However, Natan was planning to start selling it at 0.10 euros per kg in the near future, and to increase its price to 0.20 euros in 2020 (Jacquemin 2019).

In what concerns NÂM’s services, the collection of spent coffee grounds was the only in place, but it allowed for considerable customer relationship benefits. From his own experience, Natan found that restaurants and cafes were not only enthusiastic about contributing to his circular economy business, but also delighted to no longer spend money in disposable plastic bags necessary to collect a “waste”, which could represent up to 10 kg every day. (Jacquemin 2019).

Nonetheless, NÂM was also planning to open its urban farm to the public. It would offer, at certain set fees, visits to its facilities and make mushroom cultivation workshops available for those more intrigued about its production process. In this way, the start-up could attain additional revenues while addressing the great demand of people interested in knowing more about NÂM’s project. This proximity would not only allow the urban farm to better promote circular economy practices among consumers, encouraging participants to rethink what was viewed as waste, but also to strengthen brand awareness. Reputational benefits were not just expected for NÂM, but also for any of its partners (Jacquemin 2019).

Overview of the industry and target market segments

Even if its value proposition had its merits, NÃM's innovative solution for spent coffee grounds would only thrive if it could attain enough demand for it. Knowing this, Natan Jacquemin gathered data on the Portuguese mushroom industry to support his business plan.

He found that even though the Portuguese mushroom market was smaller when compared to other European countries, it showed growth potential. As per the Food and Agriculture Organization of the United Nations, in 2017, Portugal's production of mushrooms totaled 12 000 tons, with exports accounting about 12.5% of this value (Jacquemin 2019). For domestic consumption of mushrooms, in the same year, it amounted to 13 500 tons, with imports accounting around 22.22% of the value, and with the average yearly consumption per capita being 1.35 kg (Jacquemin 2019). Yet, being NÃM a local business, Natan was specifically focused on assessing the mushroom market in Lisbon, which he estimated to amount to 5 000 tons a year (Jacquemin 2019). Indeed, the capital was the most densely populated city in the country. Besides, further considering a study from Instituto Politcnico de Tomar, which assessed that Oyster mushrooms represented 30% of the total consumption of mushrooms in the country, the young entrepreneur expected the yearly market potential for this type of food to correspond to 1 500 tons in Lisbon (Jacquemin 2019).

In what concerns market segments, Natan Jacquemin targeted restaurants and cafes in Lisbon, the only one NÃM had been focusing on up until that point. Indeed, he found that according to Turismo de Portugal, there were about 4 000 restaurants in the Portuguese capital in 2017, a number foreseen to increase due to Portugal's growing economy, and to the boom in tourism that the city had been experiencing (Jacquemin 2019). The urban farm had already attracted a dozen of clients, supplying different pizzerias, brunch spots and even the traditional Portuguese "tascas" (Jacquemin 2019), who valued the quality and freshness of its mushrooms. But a key segment called for emphasis. Consumer tastes were leaning more and more towards

healthy and organic options, or even vegan or vegetarian dishes. Besides, customers' expectations and sensitivity to the quality of the products used in menus was growing. Then, since these preferences were perfectly aligned with NÃM's offer, establishments eager to meet them were the ones with most potential to become clients of the urban farm. Moreover, from Natan's experience, this kind of restaurants was particularly responsive to NÃM's mission, given their sensitivity towards the necessity of prioritizing local production and circular practices. Nonetheless, Natan also believed that, regardless of the type of cuisine, restaurant chefs who were enthusiastic about creating innovative dishes with the finest ingredients, while making conscious product purchase choices, would be great allies in this purpose as well (Jacquemin 2019).

Another opportunity for NÃM could be found in a second segment yet untapped by the urban farm: local supermarkets and grocery stores, prioritizing those that, as retailers, could uphold the start-up's local and sustainable image. Although the number of organic stores in the Lisbon area was still relatively low, NÃM expected growth in the future. Besides, this had at the time been an enduring trend even in larger supermarket chains, which created sections dedicated to organic products and expanded their biological food assortments.

Establishing restaurants, supermarkets and quality grocery stores as clients would be particularly valuable due to their more sizeable and frequent purchases. Natan estimated that, per week, a medium-sized restaurant requested 5 kg of mushrooms, whilst supermarkets' purchases ranged from 5 to 50 kg, with medium-sized ones averaging at 20 kg (Jacquemin 2019). Yet, the last untapped segment that Natan aimed to target were direct consumers, namely selling NÃM's product to the visitors of the urban farm or making the fresh mushrooms available at local farmers' markets.

Plan envisioned for the future of the start-up

Natan Jacquemin aimed to equip his circular economy business with a whole new urban farm, characterized by a consistent production capacity of mushrooms. In order to do so, according to his projections, “a facility implementation surface of at least of 475 m²” was necessary (Jacquemin 2019). Particularly, the whole space would be distributed “according to the three main stages of the mushroom production cycle: inoculation, incubation and fructification” (Jacquemin 2019). Besides, the creation of “a small pre-incubation room, serving as a buffer” between the inoculation and incubation phase, would be advisable according to NÃM’s CEO (Jacquemin 2019). Finally, the residual area would be employed as “working space for workflow, office and stock” (Jacquemin 2019) (see **Appendix 3** for the envisioned floor plan). Furthermore, in terms of key equipment, according to the young entrepreneur, “a cold room, a laminar flow, trolleys and a pasteurizer” would all be necessary to run the urban mushroom farm (Jacquemin 2019).

Moreover, in order to produce a relevant amount of mushrooms monthly, “a regular and constant collection system” had to be set up to provide NÃM with the right quantity of fresh coffee waste every month (Jacquemin 2019). Spent coffee grounds had to be notably fresh, thus, ideally, they needed to be “collected every two days” (Jacquemin 2019). This represented a key aspect in which Delta Cafés could potentially aid Natan Jacquemin’s endeavors, by becoming the sole supplier of the main input for his mushroom production, thus making the collection process far more efficient.

Considering his ambitions for the start-up and his expected financing needs, Natan Jacquemin proposed an initial capitalization to Delta Cafés’ CEO; he calculated that 135 000 euros in equity and 105 000 euros in long-term debt would cover adequate working capital for the start-up and an initial plant and equipment investment amounting to 218 000 euros. This would also allow the business to meet its long-term liabilities (Jacquemin 2019).

Weighing the potential of a partnership

After his encounter with Natan Jacquemin, Rui Miguel Nabeiro was immediately fascinated by NÃM's value proposition and creative business model. Indeed, finding profitable ways to reuse spent coffee grounds had been an aspiration at Delta Cafés for years, and one that, by all accounts, the young entrepreneur shared. The story of the start-up was captivating, not only due to its circular economy approach to waste, but also because it was perfectly aligned with the coffee company's core business. At a first glance, channeling amounts of spent coffee grounds generated by Delta Cafés to the urban farm, to be reused in the creation of a commercially valuable product, seemed to make perfect sense. Yet, from a broader perspective of Delta Cafés' reality, it was less obvious if NÃM could be an effective answer for the company's sizeable quantities of coffee waste. That is, if the start-up could revalue a considerable portion of spent coffee grounds generated by the company. Rui Miguel Nabeiro had to carefully ponder the value that Delta Cafés could realistically add to NÃM, and vice-versa, in order to invest in the venture and pursue a partnership with Natan.

At the time, sustainability was one of the areas that the coffee company was most interested in investing. Reducing its carbon footprint and compensating the environmental impact of its activities were considered a priority (Castro 2021a). And in particular, circular economy represented a very interesting model for Delta Cafés and was seen as fundamental in the future of the organization. Foreseeing that this would be where businesses and society in general would head towards, contributing to NÃM's success story could be a step in the right direction. It was, indeed, a way to give a new life to the company's coffee waste and reincorporate it into the economy. Sponsoring entrepreneurship for impact was not new to Delta Cafés. The company had already sponsored some start-ups in this field, providing them enough fund to develop the firsts tests and bring their ideas to life. The general aim was to foster a culture of innovation and have a nurturing role in interesting ventures' stories. Still, as it often

did not make sense within Delta Cafés' core strategy and activities, this did not necessarily imply committing to a fixed partnership or a capital investment in said start-ups (Castro 2021a). Indeed, with NÂM, a similar reasoning could be followed. However, to Rui Miguel Nabeiro, a simple sponsoring option seemed unchallenging and lackluster, considering that Natan had already acquired the expertise, developed his idea and started his business. By all accounts, the urban farm's concept was working, just in a very small scale. Actually, what the young entrepreneur needed was financing and support to actually grow his project. The start-up's early stage explained its modest size, revenues and overall impact. NÂM was not financially sustainable yet, had a local focus and a small client base (Partington 2019). And, at that point, it only had the capacity to turn 500 kg of spent coffee grounds into 100 kg of mushrooms per month (NÂM n.d.). So, for Delta Cafés' CEO, the question was whether or not NÂM had the potential to be scalable enough to reach significant goals in terms of sales and of environmental impact. Especially, he wondered if Delta Cafés could indeed have a crucial role in the venture's story. Only this would justify investing and holding a stake in the venture.

As with any investment, it was fundamental to understand the risks and opportunity costs involved. Evidently, even in a company as large as Delta Cafés, resources were not limitless. Choosing to invest in NÂM implied directing part of the company's innovation budget to the acceleration of the start-up, meaning that less of it would be available to fund other interesting ventures that might arise in the future. Not just within the scope of sustainability, but also in other innovation areas that may suit the company. And this was equally true for any other resources that the start-up could need. In fact, if Delta Cafés were to have a vital role in NÂM's business development and growth, Rui Miguel Nabeiro knew that coffee company could not be a mere investor, but a real partner instead. To him, that meant being involved in the venture's strategic decisions, and making its company resources available to enable the urban farm's scale up. This would require access to the organization's contact

network, and several human resources to be directly and indirectly involved in the partnership with the start-up; namely, Delta Cafés' commercial and distribution teams, as well as people tasked with the collection of spent coffee grounds, if it were to be assured by the company. Costs in time and effort should not be ignored. Hence, due to the need to phase investments, there was only a certain number of projects that Delta Cafés could approach in this way (Castro 2021a).

However, from a commercial point of view, the value proposition of NÂM's main product seemed appealing for Delta Cafés' clients. Indeed, Oyster mushrooms were a product that could be effectively directed towards the HoReCa channel (Hotels, Restaurants and Cafes), which represented a very significant part of the company's business (Castro 2021a). Adding to their great quality, flavor and unmatched freshness, their circular economy character was a differentiating factor likely to make NÂM's mushrooms stand out from the remaining market offer, attracting demand at a price aligned with competition or even justifying one set slightly higher. Nonetheless, it was important to consider that mushrooms were not common in the traditional Portuguese cuisine and that several clients from Delta Cafés were just cafes, which usually did not provide lunch or dinner plates (Jacquemin 2021). Besides, Delta Cafés would be navigating a sector in which it had no experience: the mushroom market. And, due to the uniqueness of Natan's initiative, a real industry of organic mushrooms farmed on coffee waste did not exist yet. The knowledge would, therefore, be limited, and require an extra effort within Delta Cafés' teams appointed to developing the partnership (Castro 2021a).

Moreover, as concluded in past endeavors, coming up with recovery possibilities for Delta Cafés' spent coffee grounds was not enough. They had to be feasible and economically viable, in order to be sustainable, long-term answers to the matter. Rui Miguel Nabeiro knew the same perception should be applied to an enduring partnership with NÂM. It was immediately clear that Delta Cafés generated enough spent coffee grounds to supply the urban

farm's raw material needs. Delta's extensive network of suppliers, cafes and restaurants could furnish NÂM with a copious amount of spent coffee grounds. The issue would rather be Delta Cafés' ability to find within its logistics an efficient solution to collect and deliver them to NÂM. Rui Miguel Nabeiro anticipated this challenge considering the outcome of Delta Cafés' past initiatives, as "ReThink". Naturally, reverse logistics were usually costly and characterized by great inefficiency, as all Delta Cafés' logistics were set to deliver coffee and not to collect the coffee waste back (Castro 2021a). Besides, to ensure freshness, spent coffee grounds should be collected within two days from their production, while Delta supplied coffee to its clients on average every two weeks (Castro 2021a). Hence, these particular challenges in finding logistics suitable for NÂM would need to be tackled.

Ultimately, at the time, there were no alternatives as alluring as NÂM. Rui Miguel Nabeiro truly believed in NÂM's purpose and knew that it was a unique venture in Portugal. Besides, no other coffee company in the Portuguese market had such an initiative, and this would give Delta Cafés the opportunity to be a first mover. Nabeiro deemed that a partnership between Delta Cafés and NÂM had the potential to become a best practice in terms of circular economy initiatives within the coffee industry. And even if for Delta Cafés, as a major player in Portugal's coffee sector, this partnership was unlikely to be a significant source of competitive advantage in the very short-term, investing in NÂM would be another way to reinforce Delta Cafés' positioning: a forward-thinking agri-food firm, eager to invest in conscious production models, minimize its waste and have a positive social and environmental impact.

The decision to invest

Risks, as in any innovation project, were always involved. Even if the capital required to hold a stake at NÂM was not substantial for a large company as Grupo Nabeiro-Delta Cafés, the partnership would represent a great investment in terms of people, resources and time. Yet,

the more value the company could put on the table for NÃM, and the more involved it was on the development of the venture's strategy, the more controlled the risks associated to this partnership would be. With an experienced company like Delta Cafés backing a start-up with such potential, minimal success for NÃM was expected, even if, in a worst-case scenario, this only meant recouping the investment placed (Castro 2021a).

Following this reasoning, Delta Cafés' CEO decided to invest in NÃM and, after several meetings with its founder throughout March, the deal was closed in April 2019 in a rather informal conversation. Rui Miguel Nabeiro and Natan Jacquemin ended up settling on a value, deemed reasonable by both parties, for Grupo Nabeiro-Delta Cafés to hold a 50% stake in the venture. In this manner, Delta Cafés and Natan would enter in equal parts, also being assured that the coffee company would cover the initial investments needed to scale-up the business. Lastly, Rui Miguel Nabeiro guaranteed that further necessary resources would be put available for NÃM, including a team – Delta Ventures – which would aid in the start-up's management and acceleration (Castro 2021a).

A new Business Unit

The decision to invest in NÃM led Rui Miguel Nabeiro to reflect even more on the importance of external start-ups for a large company such as Grupo Nabeiro-Delta Cafés. In an ever-changing market, driving transformation inside the organization was deemed crucial to keep up with the new consumers' trends and recognize future opportunities (Castro and Jacquemin 2021). Besides, corporate-startup partnerships were becoming more and more frequent since both start-ups and companies could provide resources that the other lacked (Dörner et al. 2020).

With this in mind, right after he decided to invest in NÃM, Nabeiro took the decision to create a new Business Unit within Delta Cafés, "Delta Ventures" (Castro 2021b). The scope of this new unit was solely to create, coordinate and manage an ecosystem of start-ups, bringing

innovation from outside into the family organization. Nabeiro' vision was to make Delta Cafés a reference company in supporting innovation projects and in empowering new generations of entrepreneurs who shared the same human values of his organization. Then, the corporation aimed at collaborating with start-ups that could impact not only the family organization itself, but also the surrounding society. Particularly, this business unit was looking, specifically in the Portuguese market, for scalable projects at an early stage that could share synergies with the coffee company. Indeed, the intent was to enter the capital of these start-ups and contribute to the strategic definition of their businesses with a proximity approach. Delta Cafés was willing to co-develop and accelerate innovative solutions by offering to its partners a highly involved relationship, putting at their disposal the consumer knowledge and the resources of a company with almost sixty years of expertise, facilitating their access to the market and providing them a dedicated and supported team (Castro and Jacquemin 2021) (see **Appendix 4** for Delta Ventures' structure).

The first steps of a pioneering initiative

The next few months were the most challenging. NÂM and Delta Cafés worked together to transform the pioneering partnership into reality while trying to integrate the small, flexible start-up within a large company as Delta Cafés (Jacquemin 2021). Some discrepancies initially existed between Natan and the Director of the New Business Unit, particularly in what concerned the strategic vision of the business. Natan, given his age and inexperience, had a more idealistic vision compared to the more pragmatic one shared across Delta Cafés. According to the Director of Delta Ventures, the sustainability project only made sense if it could be scalable in the broad reality, that is, if expanded into an actual profitable business (Castro 2021a). Besides, in order to ensure the start-up with a substantial production capacity, Natan and Delta Cafés had to locate and transform an old car dealership in Marvila into NÂM's new urban mushroom farm (Jacquemin 2021).

Furthermore, the family business had to identify a business area through which it could provide spent coffee grounds to Nãm without major inefficiencies in terms of reverse logistics. The area of vending was recognized by the coffee company as the most appropriate to overcome the inbound logistics challenge. Delta Cafés had a very big operation of vending machines and the vending team had to frequently visit them, not only to collect money, refill and clean the machines, but also to collect spent coffee grounds. Therefore, since the vending team had to collect them anyway, gathering large quantities, it would be able to secure the supply of Nãm with its main raw material at a fresh state, and without incurring substantial additional costs (Castro 2021a). In turn, the start-up would still be in charge of the production, sale and distribution of the mushrooms and fertilizer (Jacquemin 2021) (see **Appendix 5** for Nãm and Delta Cafés' key activities).

A unique project in Portugal: Transforming waste from the city into value

In August 2020, after five months of construction works initiated in March, Natan finally moved his business to Nãm's new urban farm in Marvila. The new factory became effectively operational in October of that year, with activities gaining further steam in the following months.

The young entrepreneur no longer had to walk from door to door to collect the coffee waste from cafes and restaurants in the Lisbon area. Indeed, the new collection system of spent coffee grounds started being carried out through Delta Cafés' vending logistics (Lusa 2020). Having the coffee company facilitating such a larger and efficient collection represented a huge leap for the circular economy business, as it led to an increase in raw materials that boosted its mushroom production. In January 2021, the start-up was reusing 1 631 kg of spent coffee grounds to produce 532 kg of mushrooms. Nãm's urban farm quickly reached full capacity, in June 2021. At this point, it was able to produce 1 176 kg of mushrooms by reusing 3 882 kg of spent coffee grounds (see **Appendix 6** for the evolution of Nãm's production).

Besides having provided the new infrastructure and logistics system, Delta Cafés helped the start-up to develop and consolidate, also being very committed to the commercial acceleration of the venture. Indeed, NÂM, collaborating on a daily basis with Delta Ventures' team, was able to expand its customer base while selling its fresh mushrooms to clients within a 15-kilometer radius (Garcia 2021). Furthermore, the start-up launched new products and services in the market, thus adding new revenues streams to those generated by its core business. In addition to fresh Oyster mushrooms, which remained NÂM's core product, and organic fertilizer, NÂM began selling, mainly online, dehydrated mushrooms and two different kits to grow mushrooms at home (NÂM n.d.) (see **Appendix 7** for NÂM's new products). As for services, it started offering visits to the new urban farm, at the set fee of 17.50€ per person (NÂM n.d.).

Relatively to its customer base, in which restaurants and cafes accounted for 90% of the sales (Jacquemin 2021) (local markets and visitors of the farm accounted for the remaining 10%), NÂM experienced an exponential increase in demand, reaching a total of 100-120 restaurants and cafes as clients, since the opening of the new facility. However, only 10% of them belonged to Delta Cafés' HoReCa channel (Jacquemin 2021). This fast growth was also due to the media campaign conducted by Delta Cafés, and the attention that NÂM's story captured from all Portuguese generalist channels and press. In light of this ever-increasing demand and of its "very efficient cost structure" based on raw materials at no costs, which allowed for a "very comfortable price margin", the business, which at the time already counted eight employees, was expected to reach the breakeven point by the end of 2021 (Castro 2021b).

Assessing impact

For Rui Miguel Nabeiro, accelerating NÂM's commercial success was not enough. It was crucial to measure the real impact that the urban mushroom farm in Marvila was having and, in a concrete manner, understand the difference it was making. As such, the coffee

company hired a consulting company, “3drivers – Engineering, Innovation and Environment”, to carry out the research on the CO₂ emissions saved by NÃM’s activities. The goal was to assess the environmental benefits of reusing spent coffee grounds as substrate in the mushroom production, as well as the benefits associated with their local production, proximate to consumers.

To assess NÃM’s carbon footprint, two scenarios were studied and compared: NÃM’s scenario, with an urban production of Oyster mushrooms reusing Delta Cafés’ coffee grounds as substrate, located in Lisbon; and a baseline scenario, for a traditional production of Oyster mushrooms, located in the surroundings of Lisbon and at a production scale equal to NÃM’s (Lorena and Carvalho 2020). For each of the two cases, the processes were modeled, and a Life Cycle Analysis was performed. According to the consulting firm’s results, per kg of Oyster mushrooms produced by NÃM, 2.2 kg of spent coffee grounds were prevented from ending up in landfills, lowering CO₂ emissions in 1.12 kg (Lorena and Carvalho 2020). As for the impact of the mushrooms’ distribution to consumers, in the traditional mushroom farmer’s scenario, emissions would be 0.204 kg of CO₂ per kg of Oyster mushrooms. In NÃM’s case, due to its local distribution, this impact was only estimated in 0.0151 of CO₂ per kg of Oyster mushrooms (Lorena and Carvalho 2020). Thus, computing the difference between the impact of the distribution in both cases, NÃM’s local activities led to a reduction in CO₂ emissions of 0.189 kg (Lorena and Carvalho 2020).

These unitary impact figures allowed for an estimation of NÃM’s yearly carbon footprint. Considering that the farm in Marvila continued operating at the full capacity reached in June 2021, its monthly mushroom production would be around 1100 kg (Lorena and Carvalho 2020). Assuming this capacity would remain constant for the next 12 months, the yearly production was expected to be 13 200 kg. Considering these values, spent coffee grounds being reused in NÃM’s substrate and diverted from landfills was found to avoid a yearly

negative impact of 14 781 kg of CO₂ (Lorena and Carvalho 2020). This was deemed equivalent to the emissions associated to the consumption of 74 653 cups of coffee, or the lifetime CO₂ absorption of 49 trees (Lorena and Carvalho 2020). As for the benefits of the local production of mushrooms, for the urban farm's expected yearly harvest, NÂM's activities were estimated to avoid 2 493 kg of CO₂ per year (Lorena and Carvalho 2020). This was found equivalent to the yearly emissions of 63 cars in circulation (Lorena and Carvalho 2020).

Looking towards the future

In 2021, Rui Miguel Nabeiro defined NÂM as “a victorious project that was creating value for the community, reconciling economy with ecology” (Grupo Nabeiro 2021), and as the “proof that it was possible to reduce the environmental impact and maximize the positive social impact, based on eco-efficient production and the development of sustainable initiatives” (Grupo Nabeiro 2021). He believed that, with NÂM, Delta Cafés had taken the first big step to close the cycle of coffee grounds through an interesting, feasible and economically viable solution (Nabeiro 2021). The partnership also enabled Delta Cafés to better position itself, compared to other coffee companies, in what concerned waste management.

NÂM was, indeed, an innovative circular economy venture which stood out as the only mushroom urban farm in Portugal upcycling spent coffee grounds. However, while Natan Jacquemin's concept was certainly creative, it was not unique in Europe. In this regard, because it was backed by Delta Cafés, NÂM had been able to match, in just a few months, the production capacity of its older peers with similar business models, such as the farms Natan visited before the foundation of his company (Castro 2021b). Delta Cafés had a fundamental role in this growth, boosting not only the amounts of spent coffee grounds reused in NÂM's urban farm, but also its mushroom production and sales.

Nonetheless, being a start-up in its first years, the volumes of NÂM's activity were still at an initial stage. Indeed, even with the new urban farm in Marvila having reached full capacity,

NÂM's dimension and environmental impact were relatively small. Knowing that for the production of 1 kg of mushrooms, at least 2.2 kg of spent coffee grounds were needed, alongside the other elements of the substrate, the yearly production of 13 200 kg of mushrooms (Lorena and Carvalho 2020) projected for the urban farm in Marvila would imply the reuse of, approximately, at least 29 040 kg of spent coffee grounds (see **Appendix 8**). However, as previously mentioned, in Lisbon alone, about 10 000 tons of spent coffee grounds were estimated to be generated annually (Jacquemin 2021). Besides, considering the total amount of coffee sold annually by Delta Cafés', the coffee company was estimated to generate 45 200 tons of spent coffee grounds every year (see **Appendix 9**). Hence, the coffee waste produced in Lisbon over one year and generated by the amount of coffee sold annually by Delta Cafés were, respectively, 344 times and 1556 times larger than the quantity of coffee waste NÂM was expected to reuse annually (see **Appendix 10**).

This called into question how meaningful NÂM, at the full capacity reached in Marvila in June 2021, could actually be as response to Delta Cafés' considerable amounts of coffee waste generated every year. To Rui Miguel Nabeiro, the key action had been to leap in, start the partnership and prove the operationality of the business concept. Yet, he was conscious that NÂM represented “a drop in an ocean of potential” for the coffee company (Lusa 2020). Then, for Nabeiro, the question was how to increase the amount of coffee waste upcycled by Delta Cafés, in order to make its efforts to close the cycle of coffee grounds a paradigmatic case for the coffee industry. Should Delta Cafés further scale-up what NÂM had done so far? Should it look for other possibilities, or other ventures upcycling spent coffee grounds to produce different products?

PROJECT EVALUATION REPORT

SITUATION ANALYSIS

NÂM today

As mentioned in the “Case-Study” document, in June 2021, NÂM’s urban farm in Marvila reached its full capacity, being able to produce 1 176 kg of mushrooms and reuse 3 882 kg of spent coffee grounds (see **Appendix 6**). In light of this, in order to be able to upcycle a larger amount of coffee waste, NÂM built a new factory in Famões, in Lisbon, right next to the vending operations of Delta Cafés (Castro 2021c). This new warehouse, which the start-up has financed through a loan, has begun to be operational in September 2021 (Castro 2021c; Jacquemin 2021).

With the creation of this new factory, NÂM has divided the production cycle of its mushrooms in 2 different steps. In the new factory in Famões, all raw materials are stored, prepared for inoculation, and then, mixed and pasteurised during the inoculation phase. Subsequently, once the bags are filled with the pasteurised materials, they are shifted to the incubation stage. After the incubation phase, parts of these bags are moved to the final fructification stage at the Famões factory, while another part is transported by NÂM’s team to the Marvila factory, where these bags undergo the same fructification process. As such, today, NÂM only performs the first stage of the production cycle, which involves the inoculation and incubation stages, at the new Famões factory. Besides, the start-up carries out the whole production cycle for a share of its mushrooms at the new Famões factory, while, in Marvila, it performs just the second step of the production cycle which includes only the fructification stage, for another share of its products (Castro 2021c).

NÂM’s impact

The new Famões factory and the new decentralized system of production have already allowed NÂM to increase its mushroom production capacity. Indeed, the Famões warehouse

together with the Marvila urban farm provide the start-up with a total installed capacity of 4 tons of mushrooms per month (Castro 2021c). As of December 2021, Nãm is almost producing 2 tons of organic mushrooms per month, although Nãm's new factory is not fully operational yet (Castro 2021c).

According to the consulting firm “3drivers – Engineering, Innovation and Environment”, per kg of Oyster mushrooms produced by Nãm, at least 2.2 kg of spent coffee grounds are needed, alongside the other elements of the substrate (Lorena and Carvalho 2020). Then, assuming that the new factory in Famões will start operating at full capacity, the monthly mushroom production of Nãm would be around 4 000 kg. Assuming this capacity would remain constant for 12 months, the yearly production is expected to be 48 000 kg of mushrooms. Therefore, this projected yearly mushroom production would imply the reuse of, approximately, at least 105 600 kg of spent coffee grounds (see **Appendix 11**). As per the consulting firm's results, per kg of Oyster mushrooms produced by Nãm, 2.2 kg of spent coffee grounds are prevented from ending up in landfills, lowering CO₂ emissions in 1.12 kg. Thus, considering these values, spent coffee grounds being reused in Nãm's substrate and diverted from landfills are expected to avoid a yearly negative impact of 53 760 kg of CO₂ (see **Appendix 12**). According to the authors calculations, this is deemed equivalent to lifetime CO₂ absorption of 179 trees (see **Appendix 13**).

However, as also mentioned in the “Case-Study” document, in Lisbon alone, about 10 000 tons of spent coffee grounds are estimated to be generated annually (Jacquemin 2019). Besides, considering the total amount of coffee sold annually by Delta Cafés, the coffee company is estimated to generate 45 200 tons of spent coffee grounds every year (see **Appendix 9**). Then, the coffee waste expected to be upcycled by Nãm over one year would represent 1.06% of the spent coffee grounds produced in Lisbon in one year, and 0.23% of this coffee waste generated by the amount of coffee sold annually by Delta Cafés (see **Appendix 14**).

Thus, the expected quantity of spent coffee grounds reused by NÃM is slight compared to the amount of spent coffee grounds produced solely in Lisbon annually, and to the quantity of spent coffee grounds estimated to be generated by the coffee sold annually by Delta Cafés. Therefore, particularly, through a lens of significantly tackling Delta Cafés' coffee grounds waste concerns, the overall relevance of this start-up's business model may currently be deemed low.

Research Question

In light of the previous results, an increase of the amount of spent coffee grounds upcycled by Delta Cafés appears necessary. Then, the following analysis and recommendations were developed aiming to address a particular research question:

“How can Delta Cafés significantly increase the amounts of spent coffee grounds reused, by channelling them into economically viable business opportunities?”

Throughout this report, positive impact is held as the amount of spent coffee grounds reused. Within Delta Cafés' total amounts generated, the greater the percentage of spent coffee grounds collected and reused, the lower will be the percentage of this waste that is discarded to landfills. Subsequently, by increasing the amounts of spent coffee grounds reused, Delta Cafés will be reducing CO₂ and methane emissions, and ultimately the negative environmental impact from its coffee producing and commercial activities.

The company's efforts to reuse its amounts of spent coffee grounds have arguably found some footing through NÃM. Yet, closing the cycle of coffee grounds must be a continued and purposeful endeavor. And for this endeavor to be relevant in facing the issue, positive impact must be increased and sustained by Delta Cafés through an improvement of NÃM's business and through the implementation of innovative solutions in the field.

RESEARCH METHOD

Taking into account the situation analysis of the case studied, and the research question proposed by the authors, the present report will follow a particular structure and reasoning, which was found appropriate to reach the findings needed to draft recommendations suitable for Delta Cafés.

It is important to clarify that the endeavor to answer the aforementioned research question will comprise two main topics. Firstly, the effort to increase the amounts of spent coffee grounds reused through a sustainable growth and scale-up of Nãm: it is deemed that, as Nãm grows and scales-up, its mushroom production capacity will increase as a result. This will require further quantities of the input that Delta Cafés is eager to supply – the fresh spent coffee grounds. Thus, the greater the amount of this waste channeled into this Circular Economy business, the higher will be the portion of spent coffee grounds reused by Delta Cafés.

Secondly, in tackling the research question, authors will also consider an effort to increase the amounts of spent coffee grounds reused through other additional economically viable solutions: indeed, increasing the percentage of spent coffee grounds reused by Delta Cafés may be possible with an active pursuit of more economically viable possibilities for this waste – as long as they can feasibly be sustained. It is expected that new ventures can arise by establishing value-sharing partnerships with other start-ups, as was the case with Nãm, but also through new Circular Economy solutions incorporated by Delta Cafés in its core business model (namely reusing spent coffee grounds as an input to create new products of attractive commercial value). Following this rationale, the document will henceforth be structured as detailed below:

A first research effort was the analysis of the edible mushroom market, in order to conclude on the commercial relevance and potential of further scaling-up Nãm.

Afterwards, a benchmarking effort was conducted, both against urban mushroom farms reusing spent coffee grounds, and against coffee companies reusing spent coffee grounds. This allowed to find different experiences in the market and recognize some best practices, as basis for the authors' recommendations for Delta Cafés.

From this benchmarking, a specific company's case led the authors to look into regulatory trends on waste management, namely at the European level and in Portugal, for a better understanding on the urgency with which these matters should be taken by the company.

A survey on consumer perspectives was conducted, with an aim to assess consumers' awareness on the negative impact of coffee waste, on solutions for reusing it and on the role of coffee companies in doing so. It contained 26 multiple choice questions, with a first section to characterize the sample, a second section to assess consumers' perception on the impact of coffee waste, a third section on the innovative reusage of spent coffee grounds through NÂM's business model (although, for anonymity, the name of the start-up and of Delta Cafés were not revealed) and a fourth on the potential scale-up of the mushroom urban farm. The survey got 227 valid answers. By not mentioning Delta Cafés and NÂM, it is deemed that the survey's conclusions can also be applied to other coffee companies. A limitation to mention is the significant share on the sample of non-residents in Portugal in the last 12 months.

Then, recommendations that envision an increase in the spent coffee grounds reused by NÂM were elaborated, based on benchmarking against urban mushroom farms reusing spent coffee grounds. Moreover, recommendations that envision the increment of the amounts of spent coffee grounds revalued by Delta Cafés were elaborated, based on benchmarking against coffee companies reusing spent coffee grounds and on the survey conducted.

These recommendations were, subsequently, discussed with Delta Cafés to ensure adequacy and feasibility. This allowed to filter recommendations according to relevance, and to target some of them, for further elaboration on implementation, with detailed guidance on it.

Along the report, literature was referenced to support the established theoretical options. Besides, data on NÂM and on its business model was obtained through 7 interviews and online meetings, with their duration varying between 20 and 120 minutes. The kick-off meeting served to overview the objectives of the documents to be produced. A subsequent interview with Miguel Ribeirinho, Head of Business Development – International Markets, had the goal of having a holistic view of Delta Cafés. The first meeting with Pedro Castro, Head of Delta Ventures (the company's business unit for start-ups' acceleration), had the purpose of finding more about the investment in NÂM. Afterwards, an interview with Natan Jacquemin followed, at NÂM's farm in Marvila, to better understand the venture's operations, its business model and a potential scale-up. Furthermore, one interview with Delta Cafés' CEO, Rui Miguel Nabeiro, had the objective of gaining a better insight into the company's strategy on sustainability, and on the evolution of its eagerness and efforts to reuse spent coffee grounds; specifically, through the partnership with NÂM. Two final meetings with Pedro Castro followed, with the first being focused on the synergies from the partnership between NÂM and Delta Cafés, and the second one being focused on obtaining consultation on the authors' proposed recommendations (see **Appendix 15** for detailed interviews schedule).

Despite presenting a relevant collection of information on the topic, this report still has some limitations. There was data on Delta Cafés and NÂM that was not made available for analysis, which then required some assumptions to be made, duly signaled, in order to reach conclusions. Furthermore, it is important to highlight that urban mushroom farming with spent coffee grounds as substrate is a very small and relatively recent industry, which also limits the availability of information on it. Lastly, in what concerns coffee companies' efforts to reuse spent coffee grounds, they are still generally modest.

EDIBLE MUSHROOM MARKET

In order to understand the relevance of a potential further scale-up of NĀM, it was deemed important to assess the edible mushroom market. Indeed, increasing NĀM's production capacity cannot only have an impact purpose, it must also make commercial sense.

Mushrooms represent one of the most valued food products worldwide and constitute a popular ingredient in the traditional cuisine of many countries across the world (Market Data Forecast 2021a). According to Market Data Forecast, the “global edible mushroom market size was worth USD 50.0 billion in 2021” and it is expected to rise at a “Compound Annual Growth Rate of 9.54%” during the forecast period 2021-2026, reaching “USD 78.9 billion by the end of 2026” (Market Data Forecast 2021a).

Concerning the European edible mushroom market, according to Market Data Forecast it “was worth USD 13.71 billion in 2018” and it is predicted to thrive at a “Compound Annual Growth Rate of 9.6%” during the forecast period 2021-2026, reaching “USD 21.6 billion by 2026” (Market Data Forecast 2021b). The Europe market, together with the Asia Pacific one, is foreseen to hold one of the highest Compound Annual Growth Rates throughout the outlook period (Market Data Forecast 2021a). Then, the European region, which is also predicted to own a relevant part of the global edible mushroom market throughout the projection period (Market Data Forecast 2021c), exhibits clear potential.

The fast-growing size of the international and European edible mushroom market is expected to be driven by several factors during the foreseen period. Rising consumer demand for “meat substitutes” and consumer tastes leaning more and more towards vegan food products are predicted to drive the expansion of the market both worldwide and in Europe (Businesswire 2021; Market Data Forecast 2021c). Particularly, the growing corporate investments in research and development of innovative products in these fields are foreseen to drive the European mushroom market's growth (Market Data Forecast 2021c). Besides, "the increasing availability

of mushrooms in sales channels like supermarkets, and their increasing intake as food in restaurants, hotels and cafeterias” (Market Data Forecast 2021c) are predicted to propel the expansion of the market both globally and at the European level (Businesswire 2021). Based on application, the category of “fresh mushrooms” stands out as one of the most appreciated, especially in developing countries, due to its simple accessibility and to the increasing consumer sensitivity to quality and natural food (Emergen Research 2021; Market Data Forecast 2021a). However, the growing “demand for processed mushrooms across Western countries” (Businesswire 2021) will constitute another main driving factor of the international mushroom market during the foreseen period (Businesswire 2021). Furthermore, the increasing attention to “health and wellness” (Emergen Research 2021) together with the growing consumer consciousness about the health benefits offered by mushrooms as food product (Market Data Forecast 2021c) are expected to positively impact the global and European demand for mushrooms (Businesswire 2021). Indeed, mushrooms, being rich in nutrients, represent a “superfood”, well known to “help mitigating stress” as well as to diminish “the risk of chronic conditions like cancer, dementia, and heart diseases” (Businesswire 2021). Additionally, due to their intense flavour, mushrooms allow consumers to cook with 30-40 percent less salt for the benefit of health. Finally, the growing popularity of organic products among consumers is another critical factor expected to drive the revenue growth of the international and Europe’s mushroom market (Emergen Research 2021).

Yet, in spite of these key drivers, some market constraints may limit the growth of the edible mushroom market, both at global and European level, during the outlook period. Particularly, mushrooms’ short shelf life is foreseen to partially hamper the expansion of the global and European market (Businesswire 2021; Market Data Forecast 2021c). Besides, the cultivation of this product is extremely “labour intensive” and involves elevated operating costs,

which are predicted to partly hinder the surge of the market globally and in the European region (Market Data Forecast 2021c; Businesswire 2021).

Following this analysis of the edible mushroom market over the outlook period 2021-2026, it is possible to state that the market shows great potential, and then, that an increased production capacity of NÃM would be advisable not only from an impact perspective, but also from a commercial one. Particularly, being the majority of the start-up's clients restaurants and cafes, "the increasing intake of mushrooms as food in restaurants, hotels and cafeterias" (Market Data Forecast 2021c), together with the growing popularity of organic food, suggests that NÃM's product will attain enough demand in the future to justify a further scale-up.

BENCHMARKING

Urban mushroom farmers in Europe reusing spent coffee grounds

General Overview

Even though NÃM's concept is indeed creative, it is not singular: several urban farms in Europe reuse spent coffee grounds in the production of gourmet mushrooms. The circular economy model that gives this waste a new life, avoiding its decomposition in landfills, is present in various cities. Yet, these urban mushroom farmers are deemed peers rather than competitors, as they are of a small scale and very locally focused, mostly serving the area and the communities they are inserted in. Hence, knowledge is eagerly shared between farmers and built on, as founders of these companies are much more driven by a desire to widen the use of this circular economy practice and to increase a collective positive environmental impact, rather than expanding internationally and dominating a market. In fact, NÃM's founder shared in an interview with the group that, as he planned his own venture, he visited some of these European peers, attended their courses and workshops, and absorbed the entrepreneurs' know-how and

expertise. He was then able to refine his idea, avoiding potential costly mistakes when introducing the business model in Portugal.

Because of the collaborative attitude within this niche market, which ultimately led to Natan Jacquemin's emulation of a well-developed and proven concept, NÃM has plenty in common with peer urban mushroom farmers; not only in the production processes and product offering, but also in their purpose and eagerness to educate the community within their reach. Indeed, they raise a lot of awareness on the need to rethink the way coffee waste is viewed, by engaging local businesses in the collection of the spent coffee grounds (which they normally discarded), using their residue as an input to grow mushrooms, and later selling back the final product to them. In addition, many of these urban mushroom farmers also include products that end-consumers can readily buy, such as mushroom home growing kits or various by-products of their mushrooms (such as dried/dehydrated mushrooms, mushrooms spreads, prepared meals, mushroom beers, etc.). Their educational purpose is also witnessed through many of these farms' field visits, workshops, classes or even extensive courses on how the process is done, and how participants may reproduce them to create further impact in their community.

Jacquemin's testimony regarding NÃM's peers steered our benchmarking into focusing on the European urban mushroom farmers reusing spent coffee grounds. After the research that allowed us to reach the aforementioned conclusions on a general overview of this peer group, and the extensive similarities identified, our benchmarking criteria was based on highlighting three urban mushroom farms that presented interesting distinctive features. It was deemed that they stood out relatively to NÃM's and should be highlighted.

PermaFungi (Brussels, Belgium)

PermaFungi was founded in 2013, by Julien Jacquet and William Donck (NEFF n.d.). As of 2021, it is reusing approximately 4 tons of spent coffee grounds and producing 1 ton of mushrooms per month (Jacqmain 2021). PermaFungi's employees collect coffee grounds from

numerous locations in Brussels by bike, namely from 10 venues of EXKI (a chain of healthy, "grab-and-go" restaurants), which has been its partner since this urban farm's beginnings. In 2017, the farm also began partnering with the chain of bakeries "Le Pain Quotidien", collecting spent coffee grounds from 30 of its locations, and later with the restaurant "La Fabricca" (PermaFungi n.d.). What distinguishes the last two partnerships from the first is that the mushrooms produced by PermaFungi are sold to these same bakeries and restaurants, which incorporate the product in their menu options. Moreover, PermaFungi's fresh Oyster mushrooms can be bought in almost all organic shops around Brussels, which are supplied with this harvest daily (PermaFungi n.d.).

A key feature that this urban farm added to its website/online shop is a map of points of sale, indicating not only where consumers can buy their fresh produce, but also the bakeries and restaurants where their mushrooms can be tasted in the menu.

However, some lessons can be learnt from a major setback experienced by PermaFungi. In 2016, this mushroom urban farm started an additional project to also repurpose coffee grounds as compost to grow chicory. This allowed it to increase the amounts of coffee grounds collected and reused, while having another type of harvest to sell. Nonetheless, as a social cooperative, PermaFungi had been counting heavily on subsidies to run its activities, prioritizing further impact without cautiously ensuring profitability and an income fully supported by its turnover. In 2019, the company suffered heavy losses and lost access to these subsidies, having to resort to crowdfunding and stopping this parallel project due to its lack of profitability (C. and P. 2020). Even though PermaFungi was producing up to 10 tons of chicory a month, Julien Jacquet stated in 2020: "we could not position our chicory in relation to the industrial model made in hydroponics, that is, just over water. So, we were selling our chicory for 5 euros a kg, while the market was selling it for 3.5 euros (...). Can we continue it? No." (C. and P. 2020). The company had to "absorb the losses of 2019, reduce certain expenses and

concentrate on the core business, the production of mushrooms. PermaFungi's mistake is actually to have tried too many projects at the same time.” (C. and P. 2020). Moving forward, the goal is to ensure “profitability without subsidies (...) and why not, in the process, develop in other Belgian cities such as Ghent, Liège or Charleroi” (C. and P. 2020). However, this expansion objectives have not yet materialized.

Rotterzwam (Rotterdam, Netherlands)

A second urban farm to be looked into is Rotterzwam, also founded in 2013 by Mark Slegers and Siemen Cox. In 2021, it was reusing up to 7 tons of spent coffee grounds and producing up to 1.4 tons of mushrooms per month (NL 2021). Rotterzwam was found notable for its extensive training offer for aspiring mushroom farmers. It has available various workshops, online support and a wide range of educational options, with different prices, according to the farmers goals. There are e-learning courses for those wanting to reuse coffee grounds to grow mushrooms at home, but also entry-level training for those looking to mimic the business model and start a small-scale, profitable urban mushroom farm. Particularly for the latter, Rotterzwam developed the Mushroom Master Program (4 times a year) and a Mushroom Summer School (once a year) with key, detailed learning outcomes, and access to an alumni network. Over the years, Rotterzwam has trained many entrepreneurs who went on to start their own urban mushroom farms: some of the most successful include Helsieni in Finland, Danish Beyond Coffee and Le Champignon de Bruxelles in Belgium (Rotterzwam n.d.). A Mushroom Learning Network Community was also created, which may be subscribed to for a weekly or a yearly fee.

Moreover, Rotterzwam also facilitates an easier access to supplies and equipment for aspiring mushroom farmers. It has developed its Mobile Mushroom Units (MMU), which are modular, scalable and mobile containers, optimized as mushroom grow rooms (Rotterzwam n.d.). They are fully operational once the farmer connects them to water and electricity, thus

being able to start filling substrate in the unit right away (Rotterzwam n.d.). The mobile unit costs about 30 000 euros, also existing a possibility to rent under a 5-year contract (Rotterzwam n.d.). By purchasing an MMU, Rotterzwam's e-learning course is given for free, and for two MMUs, the farmer can get a 25% discount on the Mushroom Master Program. Further necessary supplies for the farmers to initiate activity or restock are also available for purchase on the company's website.

This ready availability of equipment and supplies, aligned with a simpler access to training and continuous support from other experienced farmers, eases the process for those who intend to pursue this business model in a profitable way. The fact that the aspiring mushroom farmer needs to cover all these costs is likely to attract only those truly engaged in the circular economy mission and committed to making the business model thrive on their own. The need to cover the heavy investments made is sure to be strong incentive.

Furthermore, Rotterzwam has developed an intriguing concept: "Coffee as a Service". Indeed, after many products' use, they are discarded as waste; this is because responsibility is separated from ownership (Rotterzwam n.d.): "only if the producer remains the owner of a product over the entire life cycle, you can start working in a circular way" (Schootstra 2019). This logic can be applied to coffee beans, in a way that brings coffee roasters, local spent coffee grounds processors and coffee drinkers together to close the cycle of coffee (Rotterzwam n.d.). Essentially, this "coffee as a service" concept considers the coffee producer as the owner of the coffee beans during their entire life cycle, meaning that the customer would, in a certain way, only be leasing them to prepare coffee drinks (Rotterzwam n.d.). Following this reasoning, even after sale, the beans would remain property of the supplier, and the spent coffee grounds that result from the coffee preparation (after grinding and pouring hot water in the coffee beans) could be collected back from the customer by a local processor for their reuse (Rotterzwam

n.d.). In this way, customers would only use coffee as a service, and not discard as waste all the remaining valuable biomass.

Pilzkiste (Graz, Austria)

Pilzkiste's founders, Jasmin Kabir and Mercedes Springer, have envisioned franchising for their mushroom urban farm since its creation in 2017. This came to fruition when Christian Bauer reached out to them after learning of their business model on a TV program. After some discussions, he became a franchisee in 2019, independently producing mushrooms and opening a second Pilzkiste in Auersbach, about 54 km from the original in Graz. Founders reported a great boom in business since this move: "We had the idea of a franchise for a long time, and talked to some applicants, but nobody brought this passion and professionalism like Christian. We are very happy to have found him but are also open to other interested parties!" (Kafel 2021). Pilzkiste's website currently has a "Franchising" tab, welcoming new franchisees and leaving a contact for requests.

A partnership with retailer SPAR Austria should also be highlighted. Since July 2019, Pilzkiste's products can be bought in SPAR supermarkets in Steiermark, Südburgenland, Vorarlberg, Kärnten and Osttirol (Pilzkiste 2021). Fresh Oyster mushrooms are delivered to SPAR daily, packed in their own paper bags (which can hold up to 200 g), and consumers can weigh the produce themselves (SPAR n.d.). If the mushrooms are not readily available in the refrigerated shelves of the fruits and vegetables department, consumers can order them at the store. Future distribution to supermarkets in more Austrian federal states is planned.

As of 2021, Pilzkiste is producing up to 1.6 tons of mushrooms per month (Kafel 2021). Nonetheless, it is important to note that in March 2020, when the Covid-19 pandemic forced many restaurants/café's to shut down, Pilzkiste's founders could not collect enough spent coffee grounds from their partners to continue ensuring their mushroom production. Forced to find an emergency solution to meet demand, Styrian straw (organic and locally sourced from the

Styrian region) began being used instead of coffee grounds (Pilzkiste 2021). Since this business model change occurred in 2020, and the aforementioned partnerships and practices were put in place prior to this, they were still found relevant for an urban farm only using coffee grounds. Before this challenge, in 2019, Pilzkiste was collecting up to 4 tons of spent coffee grounds a month (Teller 2021).

Coffee companies that reuse spent coffee grounds

General Overview

Although efforts towards reusing spent coffee grounds are widespread, they have a small dimension and relevance in most coffee companies. Even so, some best practices can be found in Europe. The few companies conducting reuse of spent coffee grounds successfully experimented different techniques and methods, such as for producing fertilizer, or even for producing biofuel. In the Portuguese market, only Nestlé's and Delta Cafés' actions on reusing spent coffee grounds are relevant in terms of impact.

In what concerns criteria, to conduct benchmarking against the coffee companies reusing spent coffee grounds, it is important to note that the ones analyzed were either European or had an operational relevance in the continent. Both coffee roasting companies and retailers were considered, since some of the big players have both activities and since both are interested in coffee grounds reusing, with the retailers being the most obvious. For this analysis, different peer groups of coffee companies were constituted, according to specific criteria. The first group is composed by the main competitors in the Portuguese coffee market (a market that Delta Cafés dominates). The second group is composed by the members of International Coffee Partners (an organization of European family-owned coffee companies that promotes "impact-oriented support to coffee farmer families" (ICP n.d.), of which Delta Cafés is a member). The third is composed by B-Corp coffee companies. The fourth is composed by the leading coffee bar players in Europe, and the fifth by the European leading coffee roasters. After this selection, it

was checked which companies conducted spent coffee grounds reusing, and only 11 companies were found to mention it on publicly available information. Then, the companies and their initiatives were analyzed according to the spent coffee grounds reusing approaches and methods, quantity reused, innovation, and partnerships. In a final selection, only the companies found to have the best performance on these indicators were considered. The final peer companies selected were Nestlé (one of the largest coffee roasting companies in the world), Costa Coffee (the largest coffee bar player in Europe) and Starbucks (the third largest) (see **Appendix 16**).

Nestlé: A partnership with Groupe E Greenwatt

The swiss company Nestlé established a partnership in 2016 with Groupe E Greenwatt to create an “agricultural biogas facility, in Switzerland, that produces biogas”. In addition to slurry and manure, each year “3 000 tons of spent coffee grounds from Nespresso and Nescafé recycling sites in Switzerland” are processed to produce biogas, used to heat water for cleaning for another plant of Nestlé (Henniez bottling plant), equivalent to enough energy to power 1 000 households (Nespresso n.d.).

Costa Coffee: A partnership with Bio-bean

Costa Coffee, the British coffee bar player, partnered in 2016 with Bio-bean to send its spent coffee grounds to be transformed into “sustainable, circular bio-based products”, mainly as fire logs for wood burners, which save “80% on CO₂ emissions comparing to being sent to landfills” (Bio-bean 2021) and which end up being more sustainable fuels in heating interiors and better alternatives when comparing to burning wood or coal (WCP 2017). The 15 000 tons of reused spent coffee grounds (Costa Coffee n.d.) during the 5 years of production (3 000 tons per year) were collected from over 800 UK Costa Coffee shops (WCP 2017). And in the first 3 years of production of fire logs, the 10 000 tons of spent coffee grounds reused allowed the

diversion of 37% of the weight of all waste and the saving of 4 500 tons of CO₂ emissions (Bio-bean 2019). Not only were emissions cut, but costs were also reduced, since this method is less expensive than previously conducted incineration (WCP 2017). Moreover, Costa Coffee's partner, Bio-bean, is also the world's biggest recycler of spent coffee grounds, turning them into sustainable products for various industries. After collecting spent coffee grounds, it dries and upcycles them for reuse (Bio-bean n.d.).

Starbucks: The legal context as motivation and innovation in the reusing mode

A new food recycling law required the restaurant industry in Japan to reduce or recycle 50% of food waste until 2015. Starbucks, the American coffee bar player, looked for help in a contact lens company researching fermentation techniques, Menicon, which formulated special lactic and acid bacteria to help turn the coffee grounds into cattle feed and advised them on compost for crops. The delivery trucks began to return to Starbucks' distribution center with spent coffee grounds, instead of coming empty as before. Thus, from 2011 to 2015, Starbucks Japan reused 1 300 tons of spent coffee grounds (260 tons per year) into cattle feed and fertilizers, which could be "back to stores as milk or vegetables in (...) sandwiches" (Starbucks 2016). In 2021, three new food items with vegetables that were produced with the reused spent coffee grounds for fertilizer were made available in stores. The compost and animal feed produced were also used to produce green tea and milk (used in Starbucks beverages as well) (Starbucks 2021).

REGULATORY TRENDS ON WASTE MANAGEMENT

Taking the benchmarking above into consideration, a very important note on waste management should be made. The situation experienced by Starbucks further reinforces the urgency with which entities should view the reduction, recovery and reuse of their residues. As in Japan, the legal context in Portugal and Europe can indeed bring new rules on waste

management, and there is an established trend on legislation for environmental impact contribution, envisioning sustainable development.

At the European level, environmental, social and governance (ESG) requirements have been at the heart of the sustainability initiatives for several years now, and most businesses are focusing on waste management issues. The EU Commission takes very seriously its role of supporting companies to do business in a responsible way, introducing mandatory guidelines to promote Corporate Social Responsibility and the United Nations 2030 Agenda for Sustainable Development (European Commission n.d.). Indeed, the EU Taxonomy Climate Delegated Act has recently been implemented by the European Commission, with the objective of allowing investors to direct their investments to more sustainable companies, in order to meet the EU's environmental objectives (Thomson Reuters n.d.). Particularly, the EU Taxonomy Climate Delegated Act has given “the market a clear environmental performance benchmark, setting a common language for investors, companies, and other stakeholders” (Principles for Responsible Investment 2021).

Additionally, the European Commission adopted a circular economy monitoring framework, aiming at tracking the main trends to identify success factors in the different countries of the EU, and to evaluate if the actions already taken were effective regarding factors such as waste management. The idea is to identify best practices in the participating countries in order to drive new actions towards the long-term goal of a circular economy (European Commission 2019). Overall, the goal of the European Union's waste legislations is to contribute to the circular economy by thinking of waste as a resource in order to move towards more sustainable economic models. Each country of the European Union is expected to incorporate its own measures to promote sustainability, taking into account the specific legislations and guidelines introduced by the European Commission (Hall 2010). These measures are part of the European Green deal, a climate action plan recently implemented, which aims at meeting

the objectives of the Paris Agreement by reaching a pollution-free environment by 2050 (European Commission n.d.).

For many years, waste management in Portugal was poor and unsustainable, and the country struggled to comply with specific EU regulations (Blomeyer & Sanz 2012). In the recent years, Portugal adopted a strict waste management policy with the goal of reducing drastically waste production and its risk to the environment, while developing the potential of the circular economy, by bringing residual waste close to zero (European Commission 2019). This waste and landfill management framework, known as PERSU (Strategic Plan for Urban Residues), was approved in October 2020, imposing new conditions to citizens and companies regarding their waste production and management. In case of a breach of the framework, the business or the individual could be subject to a financial penalty depending on the gravity of the infraction (Thomson Reuters n.d.). Moreover, this legal framework incorporated different systems allowing companies to manage their own waste flow and find ways to recycle. Adding to this framework, the Ministry of Environment and Climate Action enforced several similar mandates regulating specific waste streams and treatment alternatives, such as the introduction of a landfill tax to incentivize waste producers to move towards more sustainable approaches (European Environment Agency 2016).

Within the coffee industry, these trends in legislation changes can serve as motivation for spent coffee grounds reusing. This may even become an obligation, if legislations in the country significantly increase restrictions on the amounts of waste generated. Without preparation, this would force coffee companies to rethink operations drastically. Delta Cafés should therefore consider and foresee some potential changes in legislation that can heavily affect its coffee waste management, or its clients', and act in anticipation. Inaction may be costly in the future, which is why it is crucial to continue its effort to close the cycle of coffee grounds and boost the impact of its initiatives.

SURVEY: CONSUMER PERSPECTIVES

Survey purpose and sample

As described in the Research Method section of this report, the authors have conducted a survey to understand if consumers were aware of the environmental impact of their own coffee consumption, particularly in what concerns spent coffee grounds, as well as assess consumers' perspectives on a coffee company's effort to minimize its coffee waste. It was also important to understand if consumers deemed the initiative described (reusing spent coffee grounds in a local production of Oyster mushrooms) relevant relatively to the impact issues highlighted. Another goal was to assess their interest in purchasing a product such as these mushrooms grown on spent coffee grounds, and their willingness to pay slightly more, considering its circular economy differentiating feature.

Pertaining to our sample, out of the 277 answers received, 57% of the respondents were female, 57% of them were Portuguese and 63% of them resided in Portugal for the last 12 months at least (see **Appendix** 17.1, 17.3 and 17.4). From the responses obtained, it was, thereby, possible to draw several conclusions:

1. When confronted with the environmental impact of coffee waste, consumers show concern

When confronted with the environmental impact of coffee waste on the environment, 74% of the consumers said they were not aware of its impact and 77% were not aware of what coffee brands were doing to tackle the waste generated (see **Appendix** 17.8.1 and 17.10). Also, after being informed of the environmental impact caused by coffee waste, 54% of the consumers were very or extremely concerned (see **Appendix** 17.8.2). Thereby, one can conclude that consumers' concern derives from an informed position – which is not the case in the sample – and by informing the consumers, it is possible to achieve a shift in consumption towards sustainable products.

2. Consumers are more willing to buy from coffee companies that have a solid sustainable strategy, and the fact that Delta Cafés is investing in NÂM may also lead consumers into holding the brand in higher regard

Out of the sample, 92% of consumers agree or strongly agree that companies in the coffee industry have a duty to find solutions to tackle the environmental impact of discarded coffee grounds (see **Appendix 17.11**). It was also possible to assess that 87% of consumers are more willing to buy from a coffee company which has a clear sustainability strategy, including as a priority the minimization of waste generated by its activities, and 89% admit being more willing to buy from this coffee brand relatively to its competitors (see **Appendix 17.12** and **17.13.1**). Hence, from this statistic, it is possible to conclude that NÂM and Delta Cafés can reach potential new customers by promoting their partnership. Beyond building a strong sustainable strategy, it is important to build an effort to communicate the environmental impact to consumers.

3. Consumers prefer restaurants with organic and sustainable products

Regarding this subject, the sample showed that 76% of consumers would prefer to choose a restaurant that purchases and uses a circular economy product, such as the organic mushrooms produced by NÂM (see **Appendix 17.13.4**). Furthermore, 92% believe that opening more urban farms and having more restaurants supplied with these mushrooms would have a positive impact regarding the coffee grounds sustainability problem (see **Appendix 17.14.1**). As data shows, restaurants may also win consumers from using and promoting NÂM's organic mushrooms. Consumers recognize and value the usage of sustainable products. Thus, investing in restaurants constitutes a win-win situation for business, strategy, and promotion for both parties.

4. Consumers would be interested in finding such “circular economy” mushrooms in the supermarket, even being willing to pay a slightly higher price

Considering supermarkets and grocery stores, 92% of consumers want to have fresh, organic mushrooms at the stores near them (see **Appendix 17.14.5**). Considering their contribution to circular economy, 84% of consumers would prefer such quality, fresh, organic mushrooms to other regular gourmet mushrooms if the price was comparable (see **Appendix 17.14.6**). 69% of consumers would still prefer organic mushrooms to other gourmet option, even if the price was higher (see **Appendix 17.14.7**) By analyzing the numbers from the sample, it is possible to conclude that supermarkets are a place where customers expect to have the opportunity to buy fresh, organic circular economy products. One can conclude that people are willing to pay more for NÂM’s mushrooms. Hence, NÂM should take full advantage of customer’s preferences regarding supermarkets through a specific strategy.

RECOMMENDATIONS

Recommendations for Delta Cafés, in what concerns its partnership with NÂM

Recommendation A. Focus on the core business model and ensure sustainable profitability

Taking into consideration PermaFungi’s experience, deviating from the core business model - reusing coffee grounds to produce mushrooms - may not be a wise option for NÂM (at least in a short to medium term). In fact, any harvest potentially cultivated in the urban farm by reusing coffee grounds would require significant expertise and know-how, just as Natan Jacquemin acquired for mushrooms, prior to starting his venture. This not only applies to cultivating processes, but also to how to make it a profitable endeavor. An experimenting and “learn-by-doing” approach can lead to mistakes that can be very costly, and lead to a parallel project that may have a positive impact, but not enough profitability to sustain it. Thus, a better strategy is perfect the business model and ensure stable revenue streams, before venturing into

diversifying the offer. This is what PermaFungi concluded as it shut down its chicory cultivation. Although the farm cultivated great quantities of the product, its price had to be considerably higher than the one operated in the market, due to its production costs, hence not finding enough demand.

Recommendation B: Include reverse logistics for the collection of spent coffee grounds from Delta Cafés' HoReCa channel

As per the survey previously analyzed, consumers are pleased if restaurants and cafés they visit engage in circular economy initiatives and purchase a circular economy product like NÃM's mushrooms. Thus, for any bakery, café, or restaurant, using these mushrooms on their menus can add reputational value to their brand. Besides, for Delta Cafés' HoReCa clients (Hotels, Cafés, and Restaurants), allowing them to contribute with their spent coffee grounds can be a good strategy, instead of just using those collected at vending machines. Involving them further may not only strengthen the Delta Cafés-client relationship, but also help advertise NÃM: Delta Cafés' HoReCa clients could tell their customers that the coffee they are drinking at their establishment on that day "will turn into mushrooms tomorrow".

In terms of reverse logistics, an efficient option to start with would be to establish partnerships with bakery/ restaurant chains, as PermaFungi did with "Le Pain Quotidien". Chains have their own logistics in place, with vehicles distributing its products to the locations within a certain area. As this is done, spent coffee grounds from each location could be collected by these same vehicles and, on their return, be dropped at the chain's own warehouse. Yet, unlike PermaFungi, NÃM does not need to collect them: Delta Cafés could use its own logistics to collect these coffee grounds and deliver them to NÃM, while simultaneously leaving its supply of Delta Cafés' coffee for the chain. For this, it is crucial to ensure that all the chain's locations are Delta Cafés' clients, only being supplied with its coffee.

Furthermore, having considered Rotterzwam's concept of "coffee as a service", the group finds important for Delta Cafés to create a program for its HoReCa clients to, instead of deeming the purchase of coffee beans from Delta Cafés as an "acquisition", view them as "leased". For the participants in the program, the spent coffee grounds would be collected by Delta Cafés for reuse. Informing them of the environmental costs of discarding the resulting spent coffee grounds as waste would likely ensure greater understanding of the importance to collaborate with Delta Cafés on the collection of this waste.

Recommendation C. Establish partnerships with retailers in the Lisbon area, and later other areas depending on expansion

Two of the urban mushroom farmers highlighted in the benchmarking currently have partnerships with retailers to sell their products in stores. PermaFungi not only ensures the availability of their fresh Oyster mushrooms in numerous organic shops, but also maps these locations on their website, so that consumers can easily find this information and search for the products in the stores nearest to them. Pilzkiste's partnership with SPAR Austria also shows that selling the fresh mushrooms in supermarkets is a viable option, having them on shelves daily or having the possibility to order.

Retailers are deemed important for Nãm because this would be the best way to expand its client base, increasing domestic consumption and not having the HoReCa channel with such a large share of sales (it is currently approximately 90%). Although a small portion of end-consumers may purchase Nãm's home grow kits, or even the DIY kits (for which use they would need to collect large amounts of fresh coffee grounds themselves, that their own domestic coffee consumption would hardly ensure), a large portion of the population will likely not consistently be willing to have this process at home. However, consumers would like to have the fresh mushrooms readily available at a store or supermarket near them. In fact, this was confirmed by 92% of the surveyed population and, if found at organic stores or supermarkets,

the majority would prefer the circular economy option (like NÂM's) rather than other gourmet mushrooms, even if the price was slightly higher.

Recommendation D. Scale-up NÂM and open more urban farms in other Portuguese cities, potentially through a franchising model

Considering that NÂM now has a factory handling the first part of the production process, with the urban farm in Marvila currently handling only the fruitification of mushrooms, this can indicate how other urban farms could be open in other areas, first expanding in the Lisbon region and later to other Portuguese cities, such as Porto. This expansion could be done in a franchising model, as Pilzkiste did, trusting another interested party not only with the process, but with its brand as well.

For NÂM, a cost-efficient way to ensure this would be with the franchisee carrying the investment costs in setting up the urban farm in the new location. Then, NÂM could sell the processed product (inoculated and incubated mushroom bags), produced at the factory, to the franchisee, who would simply carry out the fruitification in the urban farm, just as it is now done in Marvila. Having the fresh mushrooms produced, there could be two options: after purchasing the processed product from NÂM's factory, the urban farmer is responsible for the remaining chain, ensuring sales; or Delta Cafés/NÂM's commercial team would ensure the clients to which the mushrooms would then be sold to, thus having better control over the NÂM brand.

In any of the two cases, just as Rotterzwam, investing in the training for aspiring urban farmers would be vital, so that risks in the process are minimized. In addition, like Rotterzwam, having mobile, modular, mushroom grow rooms available for the franchisees would be a potential option to easily ensure a proper space for the urban farm to settle in a new city.

Recommendations for Delta Cafés, in what concerns spent coffee grounds reusing

Recommendation E. Explore other methods of reusing spent coffee grounds, including options to incorporate in the business model

According to the conducted survey, consumers believe coffee companies must find solutions for coffee waste and a massive share of respondents also shows higher willingness to buy from coffee companies that tackle it. Knowing that reusing spent coffee grounds is perceived as a responsibility of coffee companies, Delta Cafés should be able to increase the amount of spent coffee grounds reused. To accomplish it, besides through NÂM's contribution, Delta Cafés should look for other spent coffee grounds reusing methods and study their viability. It could, for instance, reuse them to produce biogas for heat or for electricity as Nestlé, to produce fire logs as Costa Coffee, or even for cattle feed and fertilizer as Starbucks. The reusing methods can enable the direct creation of products to be introduced in the economy, which can even end up being more sustainable solutions. That is the case of the fire logs produced with Costa Coffee's spent coffee grounds, which help cut CO₂ and methane emissions, besides also reducing costs on waste disposal.

To develop and optimize other methods of reusing spent coffee grounds, Delta Cafés should consider already available solutions offered by the market, taking advantage of well-established considerable operations, as Costa Coffee did by partnering with Bio-bean, expert in reusing coffee waste.

Moreover, the impact and benefits of reusing spent coffee grounds can alternatively be explored within the company, for instance, as Nestlé did with biogas production to power one of its factories, or as Starbucks did by making available food items, whose ingredients were produced with fertilizer made of its spent coffee grounds. Therefore, products that result from spent coffee grounds reusing could be included across Delta Cafés' businesses, being commercialized or consumed by them.

Recommendation F. Monitor, report and communicate Delta Cafés' impact and action on spent coffee grounds reusing

Based on the survey conducted, there is a wide unawareness regarding the impact of coffee waste and, also, of what coffee companies are doing to tackle this issue. In spite of this, respondents showed higher willingness to buy from coffee companies which tackle this issue. These findings support even further Delta Cafés' action on spent coffee grounds reusing. And, knowing this, the company should inform consumers on this environmental issue and communicate its role in facing it, demonstrating its contribution with the various solutions. Moreover, according to the survey, when informed, consumers tend to express concern, and their consumption patterns can also change towards more sustainable solutions and more sustainable companies. Then, Delta Cafés can also take advantage of it, specifically when offering products created with reused spent coffee grounds. Hence, for a frequent and adequate communication of these efforts, and to convey a greater sense of accountability to the market, Delta Cafés must monitor and report on its impact.

Recommendation G. Expand the collection of coffee waste to the HoReCa channel

Delta Cafés could take Starbucks example in Japan (where this coffeehouse chain delivery trucks came back empty to the distribution center) and tackle the reverse logistic problem of bringing spent coffee grounds back for reuse from the stores supplied, by making use of the company established delivery network to also collect spent coffee grounds. Collecting coffee waste from the HoReCa channel, a relevant producer of spent coffee grounds and a relevant sales channel for the company, would provide Delta Cafés with a large source of fresh spent coffee grounds. Besides, it could end up being important for these HoReCa businesses, which would be able to optimize waste management. Depending on future developments of waste management costs, Delta Cafés could even charge a fee for the collection of coffee waste,

untapping a business opportunity. Investing to adapt its trucks and prepare its current team to also collect spent coffee grounds is recommended.

CONSULTATION ON RECOMMENDATIONS

After having drafted the aforementioned recommendations, the group conducted a meeting with Pedro Castro, the Head of Delta Ventures, currently working closely with NÃM on its partnership with Delta Cafés. Obtaining insights from the coffee company on the group's research method and conclusions was deemed fundamental, to take into account NÃM and Delta Cafés' specificities (both as individual entities and within the partnership), as well as assess the relevance, feasibility and operationality of the suggested recommendations.

In a general sense, all were found appropriate for Delta Cafés' effort to close the cycle of spent coffee grounds, particularly to increase the amounts reused by the company. Nonetheless, some implementation concerns were raised, which led the group to categorize the recommendations according to their relevance and viability across time; namely as short-term (one year), medium-term (two to three years), and long-term (more than three years) recommendations. It was then possible to complement and restructure the drafted recommendations into those most suitable for Delta Cafés, or NÃM's strategy for the future.

Recommendations for Delta Cafés, in what concerns its partnership with NÃM

As abovementioned, the four recommendations proposed to NÃM were all taken as valid. Yet, considering the information provided by Pedro Castro, the group found two of the propositions to be less suitable as next steps for NÃM to take in a short to medium-term:

Recommendation A: Focus on the core business model and ensure sustainable profitability

This recommendation was considered a crucial short-term approach to NÃM. However, both NÃM and Delta Ventures already hold this outlook on the business. Indeed, the venture is

still at an early stage, in which the main goal is to perfect the current business model, boost efficiency and consolidate NÃM's cost structure and financial standing. Hence, NÃM's growth and effort to increase the amounts of spent coffee grounds reused is already projected to rely on the core product offering (organic mushrooms), rather than diversifying the offer through other types of harvest, cultivated with spent coffee grounds. Any additional revenue streams are expected to derive from mushroom by-products (as was the case with home mushroom growing kits or dehydrated mushrooms). As such, this recommendation was assumed redundant by the group, and was therefore dropped.

Recommendation B: Include reverse logistics for the collection of spent coffee grounds from Delta Cafés' HoReCa channel

The assessment of this recommendation's relevance and feasibility was divided in both short-term and long-term outlooks. In fact, at this consulting meeting, the group was informed that NÃM had very recently developed a new partnership with "A Padaria Portuguesa", a Portuguese chain of bakeries, for both the collection of spent coffee grounds and the subsequent sale of mushrooms produced, to use in their menu options. Specifically, "A Padaria Portuguesa" collects daily fresh spent coffee grounds from its various locations in the Lisbon area (it is ensured that all these locations use Delta Cafés' coffee), accumulating this waste at the chain's central warehouse. From there, Delta Cafés' logistics take over, transporting the total amount of spent coffee grounds from the chain's central warehouse to NÃM's factory. The remaining process of production and commercialization of the mushrooms by NÃM continues as established. It is important to note that, since the bakeries' chain has its own logistics system in place, to visit all the locations on a daily basis (with each distributor having to complete a small number of deliveries, all with similar orders), this enables an efficient collection of spent coffee grounds, as well as their fresher state (which is better for the mushrooms' production), without

any additional cost for Delta Cafés. Therefore, NÂM partnering with a chain of Delta Cafés HoReCa clients, such as “A Padaria Portuguesa”, allows the coffee company to collect a greater amount of fresher spent coffee grounds from a sole location. Thus, focusing on this strategy is deemed the most feasible and efficient option in the short-term. Nevertheless, because the company has recently engaged in this short-term effort, which will likely be replicated for other chains in the future, the group found this recommendation redundant.

However, comparing the situation aforesaid to the collection from independent hotels, restaurants, and cafés, we find this is not as efficient. Delta Cafés could indeed collect coffee waste when it delivers its brand’s coffee, but the fact that its distributors make around 25 deliveries per day (Castro 2021c); managing stock inside the truck, and the space for the coffee and the spent coffee grounds, would thus be more difficult. Additionally, according to Pedro Castro, expanding the collection of spent coffee grounds to Delta Cafés’ individual HoReCa clients would require a longer time and effort: extensive investments in logistics systems and human resources, suitable to ensure a “door-to-door” collection, would be necessary. Because of this, the group did not consider this option feasible in a short to medium-term.

Lastly, it is important to consider that, without an extremely significant scale-up of NÂM, attaining such large amounts of spent coffee grounds was deemed ineffective. Indeed, without a considerable boost to NÂM’s production capacity, the urban farm cannot reuse such hefty amounts of spent coffee grounds as substrate in the production of its mushrooms. Delta Cafés currently has access to considerable quantities of this waste through its vending channel, and potentially through further partnerships with its HoReCa clients organized in chains. Thus, due to the costs that would be incurred in finding efficient logistics for the individual HoReCa clients, this effort was ultimately disregarded as a non-priority in the short to medium-term.

Overall, due to all aforementioned, this recommendation was deemed unsuitable by the group, hence being dropped.

Recommendations for Delta Cafés, in what concerns spent coffee grounds reusing

Regarding the recommendations for Delta Cafés, focusing beyond the coffee company's partnerships with NÂM, the information provided by Pedro Castro led the group to consider one of the three propositions to be less appropriate as next steps for Delta Cafés to take in the next few years:

Recommendation G. Expand the collection of coffee waste to the HoReCa channel

Regarding this recommendation, the challenges are the same as those stated in NÂM's "Recommendation B: Include reverse logistics for the collection of spent coffee grounds from Delta Cafés' HoReCa channel". Delta Cafés understands and highlights the importance of the recommendation in terms of increasing the amounts of coffee grounds collected, but believes it will only be feasible in a long term, due to the investments incurred and the need to refine the efficiency of reverse logistics for its individual HoReCa clients. Moreover, the priority of this recommendation highly depends on finding additional viable possibilities to reuse the spent coffee grounds collected.

Hence, the recommendation was not held as feasible or a priority in the short to medium-term, thus being dropped from deliberation.

TARGETED RECOMMENDATIONS

After the consultation endeavor with Delta Cafés, in which recommendations were deliberated as described in the previous section, four of the initial proposals were understood as the most appropriate to analyze further. It is believed that they are not only relevant to answer this evaluation report's overriding research question, but also feasible for the coffee company to act upon. For that reason, according to discernments of Delta Cafés, recommendations were prioritized according to the effort required from both NÂM and Delta Cafés to enact them, and

to the impact (reusage of spent coffee grounds) that can be attained by following them (See **Appendix 18**). They were targeted as follows:

Recommendations for Delta Cafés, in what concerns its partnership with NÂM

Recommendation C. Establish partnerships with retailers in the Lisbon area, and later other areas depending on expansion

Deemed relevant, feasible and with a short-term operationality. Henceforth, it will be indicated as “Recommendation 1. Establish partnerships with retailers in the Lisbon area, and later other areas depending on expansion”.

Recommendation D. Scale-up NÂM and open more urban farms in other Portuguese cities, potentially through a franchising model

Deemed relevant, feasible and with a medium-term operationality. Hereafter, it will be referred to as “Recommendation 2. Scale-up NÂM and open more urban farms in other Portuguese cities, potentially through a franchising model”.

Recommendations for Delta Cafés, in what concerns spent coffee grounds reusing

Recommendation F. Monitor, report and communicate Delta Cafés’ impact and action on spent coffee grounds reusing

Deemed relevant, feasible and with a short-term operationality. Henceforth, it will be mentioned as “Recommendation 3. Monitor, report and communicate Delta Cafés’ impact and action on spent coffee grounds reusing”.

Recommendation E. Explore other methods of reusing spent coffee grounds, including options to incorporate in the business model

Deemed relevant, feasible and with a medium-term operationality. From this section on, it will be referred to as “Recommendation 4. Explore other methods of reusing spent coffee grounds, including options to incorporate in the business model”.

IMPLEMENTATION

From the group's research, and complementing with Delta Cafés/NÂM's considerations on the recommendations, it was possible to draw considerations on the implementation of targeted recommendations in the short, medium, and long-term.

Recommendations for Delta Cafés, in what concerns its partnership with NÂM

Recommendation 1. Establish partnerships with retailers in the Lisbon area, and later other areas depending on expansion – Short-Term

Regarding Recommendation 1, the group's operational suggestion is for NÂM to continue distributing fresh mushrooms to small city markets but invest in their dehydrated version of the mushrooms, to start selling to big retailers such as supermarkets. Now, NÂM produces dehydrated mushrooms by using Delta Café's machinery. However, to enter in the retailer's industry (e.g., Supermarkets such as Auchan or Lidl), it will be necessary a one-time investment on technology to dehydrate fresh mushrooms of around 5 000 euros, according to average market prices, to provide NÂM with its adequate own machinery. An additional investment of between 55 216 euros and 92 862 euros yearly (see **Appendix 19**) will be required since a team of brand strategists, marketeers and designers will be needed to build the packaging, distribution, and marketing plan for NÂM's entrance on supermarkets around the country, (assuming that the firm will use their current factory and machinery to produce the new packages). Hence, NÂM would not only increase sales but also potentialize brand's awareness and new customer acquisition.

Recommendation 2. Scale-up NÂM and open more urban farms in other Portuguese cities, potentially through a franchising model - Medium and Long-Term

Recommendation 2 raises several operational, financial, and even strategic concerns for NÂM. After the consultation with Delta Cafés, another possible scale-up scenario has been

raised, then, three different scenarios were studied to understand how to scale-up NÂM in the medium and long term. In all three scenarios, the creation of four to five new urban farms in the Lisbon area in the next two/three years was envisioned. Besides, a further scale-up of NÂM to Porto in a longer term was considered.

In the first scenario, Delta Cafés would cover the entire investment, fully financing the creation of new urban farms in the Lisbon area. According to Delta Cafés, each would require a full investment of around 60 000 euros, hence, Delta Cafés would spend between 240 000 and 300 000 euros in urban farms in the medium term (Castro 2021c). In a longer term, NÂM's scale-up to Porto would require building a whole new factory, which would involve an investment of around 250 000 euros, according to Delta Cafés, including an investment of around 100 000 euros in an industrial pasteurizer needed for the inoculation process (Castro 2021c). The strategy of investing in urban farms could be applied in Porto as in Lisbon.

Regarding the second scenario, NÂM could use a franchising option in which farmers would invest in the urban farms themselves. NÂM would sell them the unfinished product, mushroom bags pasteurised and incubated at NÂM's factory, and the farmers would just take care of the mushrooms' fructification in their own urban farms. Particularly, the franchisees would receive specific training from NÂM about this specific process to guarantee the quality of fructification and mushroom collection. Besides, the farmers would carry out the commercialization of the organic mushrooms. In the medium term, this scenario would not require any investment by Delta Cafés. However, NÂM's further scale up to Porto would entail the creation of a whole new factory, which would require an investment of around 250 000 € by the coffee company (Castro 2021c). Besides, the franchising strategy for the creation of additional urban farms could be applied in Porto as in Lisbon.

For the third scenario, a franchising option would also be pursued, although in this scenario, after the fructification phase at the franchisee's urban farm, NÂM would buy back the

mushrooms to sell them to final consumers. Therefore, the third scenario would be equal to the second one aside from the fact that NÃM would take care of the commercialization of the final product. The main purpose of this recommendation is to provide an efficient scale up for NÃM that results in a significant impact on Delta Cafés' reused spent coffee grounds, and then, on the company's carbon footprint. The first scenario of NÃM's scale up, when compared to the two following franchising ones, would not be optimal regarding financing – as it would require large investment by the coffee company – and strategy – as it would be slower compared to franchising. Instead, a franchising option would be advisable since studies show that risk of failure is lower in recent organizations when compared to adolescent firms, plus, firms that invest in a high proportion of franchised outlets – urban farms, in NÃM's case – when compared to company owned outlets are more profitable (Calderon-Monge, Pastor-Sanz, and Huerta-Zavala 2017). Besides, by inoculating and incubating the product at NÃM's factory, the firm would eliminate the risk of the franchisee becoming a competitor after the expiration of the franchise agreement (Baresa, Ivanovic, and Bogdan 2017) since there is a part of the business process and knowledge that is not revealed to the franchisee. However, in the second scenario, being the franchisee to sell the final product to consumers, there are risks to NÃM regarding the loss of customers – that would belong to the franchisee and not NÃM – and regarding the loss of control over the franchisee business units in terms of quality of the product, and then over the brand.

Therefore, the group's recommendation is for Delta Cafés to pursue with the third scenario, as it appears as a solution to risk management issues regarding loss of customers and loss of control over the franchisees, and then over the brand, since NÃM would take control of the quality and distribution of the organic mushrooms while growing rapidly using a franchising business model.

Recommendations for Delta Cafés, in what concerns spent coffee grounds reusing

Recommendation 3. Monitor, report and communicate Delta Cafés' impact and action on spent coffee grounds reusing – Short-Term

The goal of this recommendation is for Delta Cafés to be aware, as an organization, of its impact and be equipped to communicate it.

The transparency demanded on impact management has been leading more companies worldwide to pursue impact reporting, and many benefits may arise from doing so. These would stand for Delta Cafés as well. Impact reporting can allow a company to make “conscious business decisions” (Turjak-Čebohin n.d.) and to conduct an “appropriate allocation of resources” (Turjak-Čebohin n.d.). The transparency promoted by it and its communication can allow for the alignment of customers' purchasing choices and employees' career options with their values. In the future, Impact-weighted accounting will reveal “a firm's overall value to society through its impact” (Cohen and Serafeim 2020). And while governments will be able to tax companies directly for the negative impacts they have, they will be also able to direct incentives “for companies to deliver positive impact through their products, operations and employment practices” (Cohen and Serafeim 2020).

Knowing this, Delta Cafés should track the evolution of selected indicators on impact, and report on them to show progress, including the publication of yearly sustainability reports. Delta Cafés should determine quantitative key performance indicators (KPIs) and targets for the relevant United Nations Sustainable Development Goals and link them to societal impact (Scott and McGill 2018). A specific suggestion would be for Delta Cafés to measure the total quantity of spent coffee grounds reused from all reusing methods it pursues. It should then assess the negative impact avoided, as well as equivalence to other indicators that better describe impact (equivalence to cars' emissions avoided or to trees' CO₂ absorption capacity). With these metrics, Delta Cafés would be better equipped to communicate the company's

efforts towards the circularity of coffee grounds. It could communicate them to the final consumer, through the main traditional means (television, radio, Internet, social media, billboards, Delta's sugar packages, events, sponsorship). With an expectedly rising consumers' awareness of Delta Cafés' efforts, attracting more customers and, for instance, influencing them to recycle more coffee capsules (from which spent coffee grounds could be extracted for reusing) would be possible. HoReCa clients would also be more willing to cooperate in the collection of spent coffee grounds. This would, ultimately, lead to an increase in the amount of spent coffee grounds reused.

After measuring impact properly and regularly, Delta Cafés could ponder its participation in sustainability indexes and achieve sustainability certification. The company already integrates the Business Council for Sustainable Development – Portugal (BCSD Portugal) (BCSD n.d.), but it could also ponder and assess its application to become a B Corp certified company. It would allow to better set goals for improvement, compare performance, and identify best practices, leading the company to achieve higher standards on social and environmental performance, transparency, and balance between purpose and profit (“B-Corp” n.d.).

With an implementation on the short term, this recommendation would require the company to establish a strategy on sustainability, bringing it to decision making. A sustainability department in Delta Cafés should be created with a designated team responsible for the execution of the strategy, establishing a bridge between different company departments, and also handling the elaboration and publication of yearly sustainability reports, for instance.

When measuring impact, Delta Cafés should assess what is the certain outcome in a period, who experiences it, how much of the outcome occurs, if it would happen anyway and what is the risk that impact is not as expected (Impact Management Project n.d.). Considering this, it is important to highlight that the company might have a limited capacity on doing this

exercise and on establishing clear indicators and metrics that can be monitored and then communicated. A sustainability-dedicated department would involve more expenses, and the communication of Delta Cafés' impact and developments on its actions would imply additional costs in marketing.

*Recommendation 4. Explore other methods of reusing spent coffee grounds, including options to incorporate in the business model – **Medium-Term***

The goal of this recommendation is to increase the amount of spent coffee grounds reused and to diversify the methods of reuse, developing new products out of waste. The partnership with NÂM is a step towards the impact Delta Cafés wants to achieve but there are other solutions that can derive from spent coffee grounds reuse.

Based on the benchmarking against coffee companies, it can be concluded that partnerships were key to tackle the lack of expertise and scientific knowledge in the development and in the processes of certain spent coffee grounds reuse methods, culminating in innovative and high-quality products, for the analyzed coffee companies. Establishing partnerships and gathering academic institutions, research institutes, and other companies, to reassess and update the economic value of spent coffee grounds for the various reuse methods is recommended to Delta Cafés. To operationalize this, a priority would be to conduct a second version of Project ReThink. Such a project would set the ground for a more intense reuse of coffee waste by Delta Cafés and for the creation of new products made of it.

The first version of Project ReThink led to the establishment of Delta Cafés' innovation management model (Delta Cafés 2021) and the company currently also has an innovation center, Diverge Innovation center, responsible for the R&D projects and for many successful products released by the company in the last decade (Grupo Nabeiro n.d.). A second version of the project is expected to be better followed by the company, which acquired a culture of innovation and scientific knowledge.

Regarding expected constraints and challenges, there is the risk that the reusing methods analyzed in the first version in 2011, besides for composting for fertilizer (Delta Cafés 2021), continue not being financially viable. New hypotheses found for reusing spent coffee grounds can turn out to be not applicable or financially viable either. This would mean that the costly research could be a failure in finding more business opportunities out of spent coffee grounds.

The implementation of the project would require a strong involvement from the company, as well as significant additional costs in R&D since this type of program requires costly investments. Back in 2009, the first version of Project ReThink was financed by national funds of 2 million euros (Delta Cafés n.d.).

And since such a project involves establishing partnerships and developing long phases of research, its implementation is expected to take place on the medium term and have a duration of three years, such as the first version of Project ReThink, which was from 2009 to 2011 (Delta Cafés n.d.).

CONCLUSIONS

Based on the case study learnings about the partnership between Delta Cafés and NÃM and the update on the firm's production and achievements, a research question was asked to analyze the business opportunities that could arise in the future for NÃM: "How can Delta Cafés significantly increase the amounts of spent coffee grounds reused, by channeling them into economically viable business opportunities?". Given the fact that NÃM significantly increased its level of production during the early stage of the business so far, the amount of spent coffee grounds reused by NÃM is far from the one produced by Delta Cafés as waste with a huge negative impact to the environment. Therefore, it was crucial to analyze and recommend a viable plan to scale-up NÃM into creating a significant impact for Delta Cafés.

With the goal of the research conducted being an increase of the amount of spent coffee grounds reused by the coffee company, understanding the recent market on urban mushroom

farming with this waste was important. While our benchmarking analysis led us to find it one with potential of growth and development, there were few statistics to substantiate this. There were several limitations, regarding lack of data and the fact that this is a small industry, hence, assumptions were taken to make it possible to draw recommendations and conclusions that could suit the case of NÃM. Benchmarking was, thus, crucial to understand the business models of several other urban farms in Europe that are reusing spent coffee grounds to produce mushrooms and key learnings were taken to be implemented at NÃM. Also, it was essential to understand the consumer perspectives through a survey that, together with the benchmarking, disclosed the existence of a space for a scaled-up NÃM in the Portuguese market that could create a significant impact for Delta Cafés.

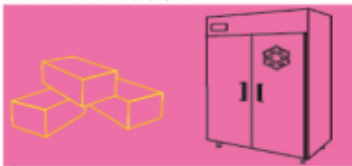
From an exhaustive work of research and a subsequent consultation with Delta Cafés and NÃM, it was possible to draw a plan to the short/medium term regarding the strategy of Delta Cafés, including robust objectives for the near future. It became clear that NÃM is ready to engage with retailers by establishing new partnerships and to build more urban farms in other Portuguese cities, potentially through a franchising model. Also, Delta Cafés should monitor and report their impact on spent coffee ground reusing and, as NÃM does not solve the entire problem regarding the firm's waste, Delta should also explore other methods of reusing spent coffee grounds, always incorporating these solutions in the business model of the company.

Hence, the research question proposed by the group at the beginning of this project evaluation report was answered with a clear plan both for Delta Cafés and NÃM. It is proven to be possible to create a partnership with strong synergies and even distinctive objectives that culminate in the success of the partnership itself. Scaling up NÃM provides a sustainable future for the business and creates a positive impact for Delta Cafés at the same time. Delta Cafés' CEO, Rui Miguel Nabeiro, once said "if you are not profitable, you are not sustainable" and this research provides clear plan for the future, a coexisting sustainable and profitable future.

APPENDIXES

Appendix 1 Production cycle of NÃM's mushrooms

a. Detailed production cycle

Stage	Description
STORAGE & PROCESSING 	Raw materials are stored and then prepared for inoculation (Jacquemin 2019).
INOCULATION 	The first real stage is inoculation . During it all raw materials (spent coffee grounds, straw and seeds of mushrooms) are mixed and pasteurised in the pasteuriser. Special attention needs to be given to not get infection. This is done by placing a laminar flow and keeping the inoculation room clean (Jacquemin 2019).
INCUBATION 	Once the bags are filled with pasteurised coffee grounds, straw and mushroom seeds, they are moved to the incubation stage . There, special conditions need to be met: a high level of CO ₂ , no light, 20 degrees ambient temperature and a relative humidity of 70% (Jacquemin 2019).
FRUCTIFICATION 	After three weeks, the bags are moved to the final stage; fructification . Abundant humidity, 16 degrees average temperature, 10 hours LED light per day and fresh air inflow at a rate of 10 times the volume of the room will make the mushrooms bloom. This stage also lasts 3 weeks and yields 20% of the weight of each bag in Oyster mushrooms (Jacquemin 2019).

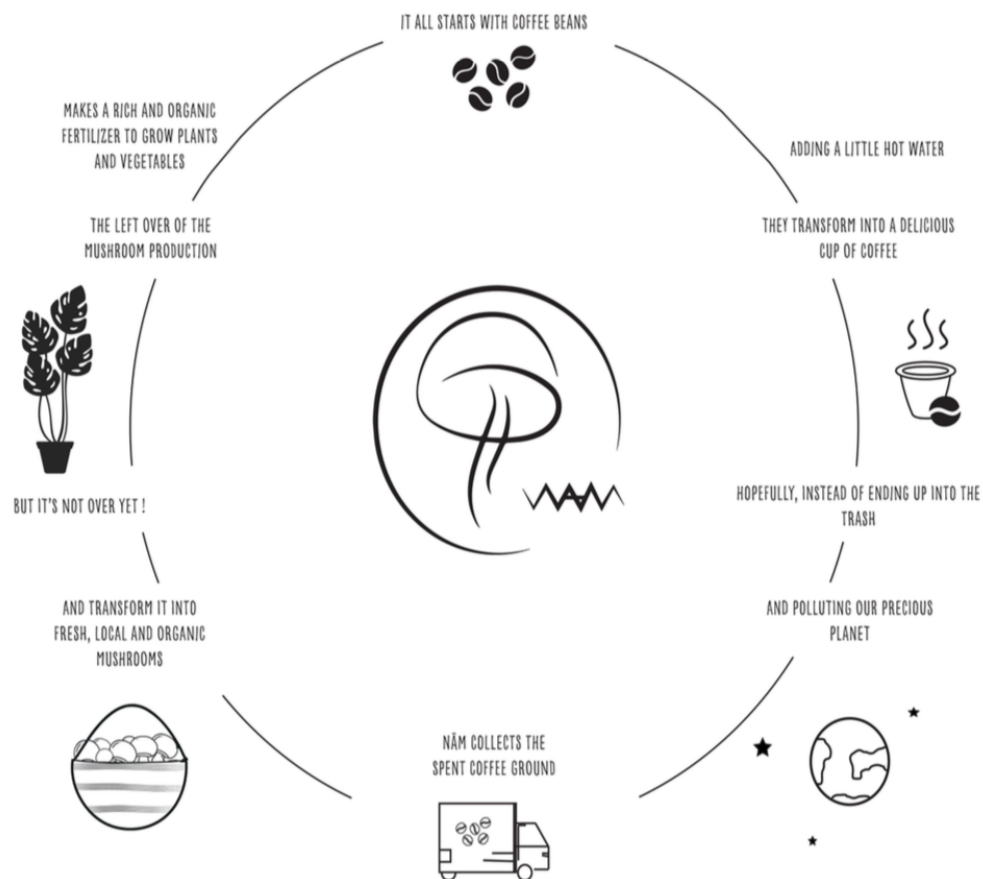
Source: NÃM's business plan presented to Delta Cafés, 2019

b. Fructification stage



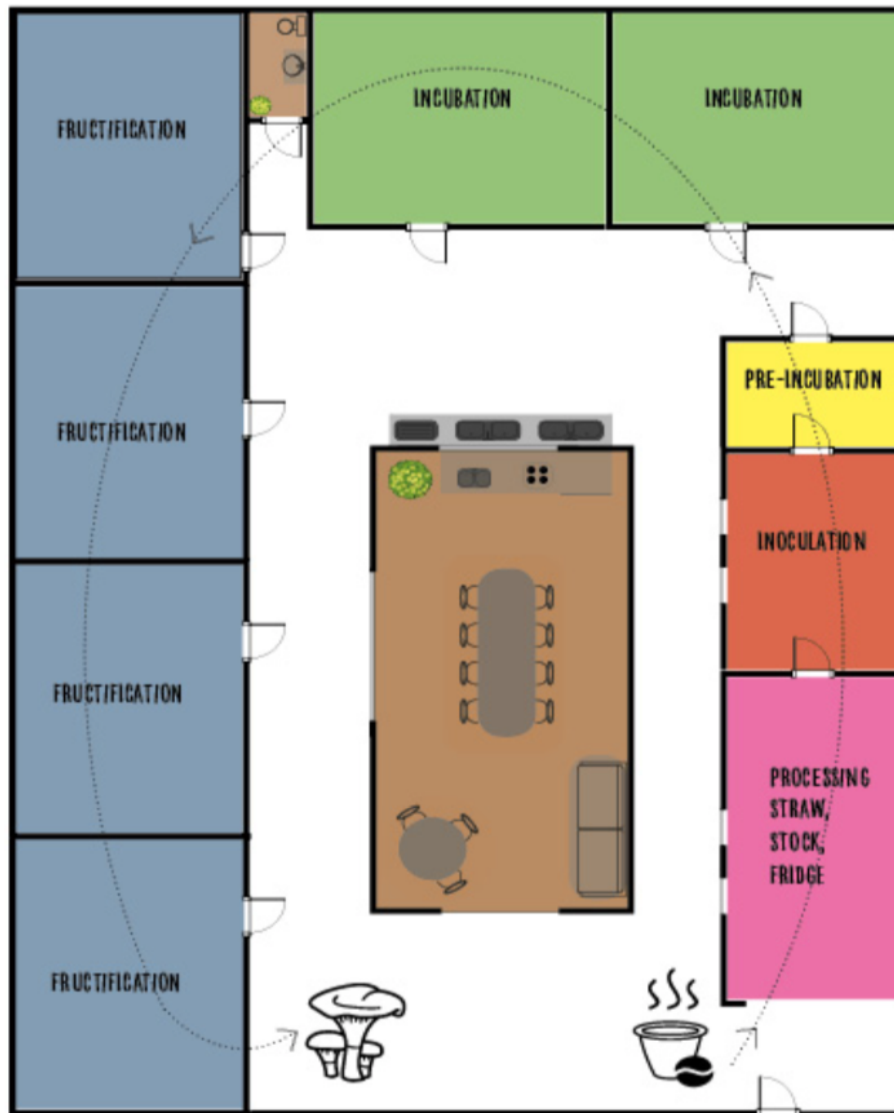
Source: NÃM's website

Appendix 2 NÃM's key activities- 2018



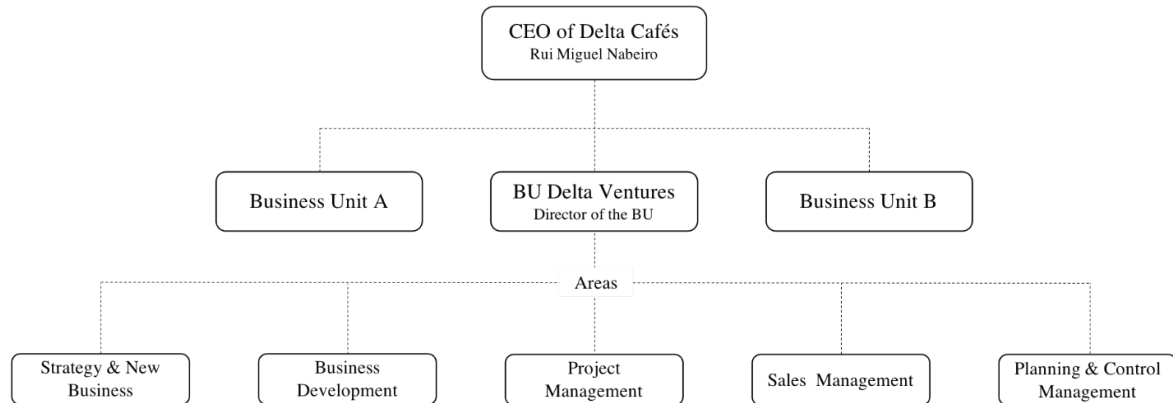
Source: NÃM's business plan presented to Delta Cafés, 2019

Appendix 3 Envisioned floor plan for NÃM's new urban farm



Source: NÃM's business plan presented to Delta Cafés, 2019

Appendix 4 Delta Ventures' structure



Source: Delta Cafés

Appendix 5 NÂM and Delta Cafés' key activities – 2020



Source: NÂM's website

Month (2021)	Coffee Waste collected	Production Volume of Mushrooms (kg)	Sales Volume of Mushrooms (kg)	Substrate (converted to fertilizer after production) (kg)
January	1631	532	499	4954
February	1848	641	495	5492
March	2112	867	695	6559
April	1859	506	458	6942
May	1804	794	686	5567
June	3882	1176	832	5755

Appendix 6 NÃM's production in 2021

Source: NÃM and Delta Cafés

Appendix 7 NÃM's new products

a. NÃM's dehydrated mushrooms



Source: Nãm's website

b. Nãm's Classical Home Grow kit



Source: Nãm's website

c. Nãm's Do It Yourself Grow Kit



Source: NÂM's website

Appendix 8 Minimum amount of spent coffee grounds required for NÂM's expected yearly production of mushrooms, at Marvila's maximum capacity (kg)

Yearly expected production of mushrooms by NÂM, at Marvila's maximum capacity (kg)	Minimum amount required of spent coffee grounds to compose the substrate needed to produce 1 kg of mushrooms (kg)	Minimum amount required of spent coffee grounds for the expected yearly production of mushrooms by NÂM, at Marvila's maximum capacity (kg)
13 200	2,2	29 040

Source: "Cálculo Da Pegada de Carbono Da Atividade Da Nâm Mushroom", 3 Drivers

Appendix 9 Amount of spent coffee grounds generated with the consumption of the total amount of coffee sold by Delta Cafés per year (Tons)

Total amount of coffee sold by Delta Cafés per year (Tons)	Amount of spent coffee grounds generated with the consumption of the total amount of coffee sold by Delta Cafés per year (Tons)
22 600	45 200*

Source: Grupo Nabeiro

*Rationale: Spent coffee grounds weigh, approximately, the double of coffee grounds. (Source: Delta Cafés)

Appendix 10 Comparison of NÂM's minimum amount required of spent coffee grounds for the expected yearly production of mushrooms, at Marvila's maximum capacity, with the amount of spent coffee grounds generated with the consumption of the total amount of coffee sold by Delta Cafés per year, and with the amount of spent coffee grounds generated with the consumption of coffee in Lisbon

Amount of spent coffee grounds generated with the consumption of the total amount of coffee sold by Delta Cafés per year (Tons)	Amount of spent coffee grounds generated with the consumption of coffee in Lisbon (Tons)
45 200	10 000

How many times, approximately, is it superior to the minimum amount required of spent coffee grounds for the expected yearly production of mushrooms by NÃM, at Marvila's maximum capacity?	1556 X	344 X
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Source: Authors

Interpretation: Delta Cafés' coffee sold in one year generates a quantity of spent coffee grounds, approximately, 1712 times larger than NÃM's annual expected quantity reused of spent coffee grounds, at Marvila's maximum capacity. Lisbon's coffee waste generated annually is, approximately, 344 times larger than NÃM's annual expected quantity reused of spent coffee grounds, at Marvila's maximum capacity.

Appendix 11 Minimum amount of spent coffee grounds required for NÃM's expected yearly production of mushrooms, at Marvila and Famões' maximum capacity (kg)

Yearly expected production of mushrooms by NÃM, at Marvila and Famões' maximum capacity (kg)	Minimum amount required of spent coffee grounds to compose the substrate needed to produce 1 kg of mushrooms (kg)	Minimum amount required of spent coffee grounds for the expected yearly production of mushrooms by NÃM, at Marvila and Famões' maximum capacity (kg)
48 000	2,2	105 600

Source: "Cálculo Da Pegada de Carbono Da Atividade Da Nãm Mushroom", 3 Drivers and Authors

Appendix 12 Total CO₂ avoided for the expected yearly production of mushrooms by NÃM, at Marvila and Famões' maximum capacity (kg CO₂)

Avoided impact from deviation of SCGs from landfills per kg of mushroom produced by NÃM (kg CO ₂ eq)	Total CO ₂ avoided for the expected yearly production of mushrooms by NÃM, at Marvila and Famões' maximum capacity (kg CO ₂)
1,12	53 760

Source: Authors

Appendix 13 Equivalence in trees of the total CO₂ avoided (kg) for the expected yearly production of mushrooms by NÃM, at Marvila and Famões' maximum capacity

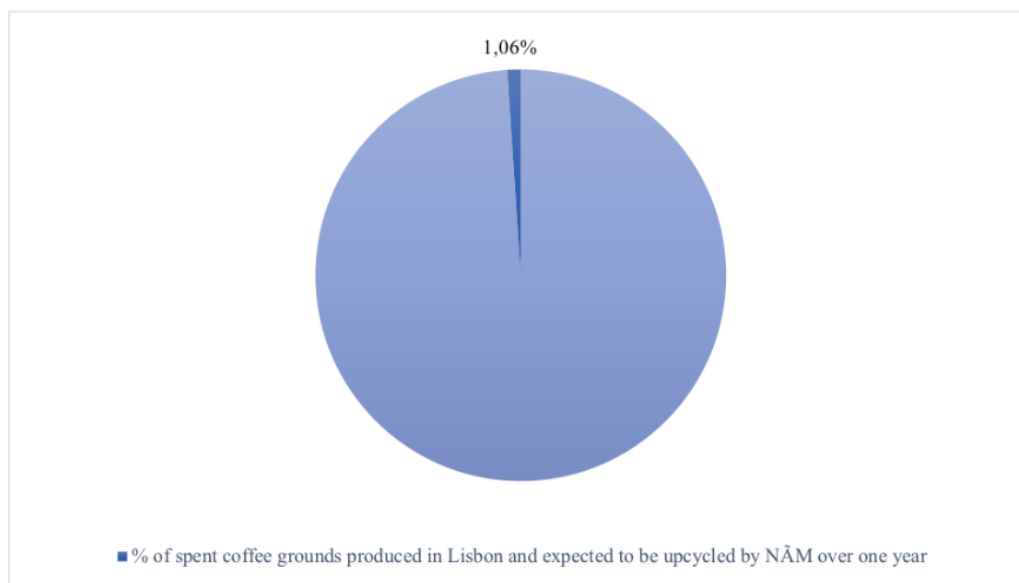
Amount of CO ₂ absorbed by trees in its life span (kg CO ₂ e/ 30 years)	Equivalence in trees of the total CO ₂ avoided (kg) for the expected yearly production of mushrooms by NÃM, at Marvila and Famões' maximum capacity
300	179

Source: Authors

Appendix 14 Comparison of NÃM's minimum amount required of spent coffee grounds for the expected yearly production of mushrooms, at Marvila and Famões' maximum capacity, with the amount of spent coffee grounds generated with the consumption of coffee in Lisbon

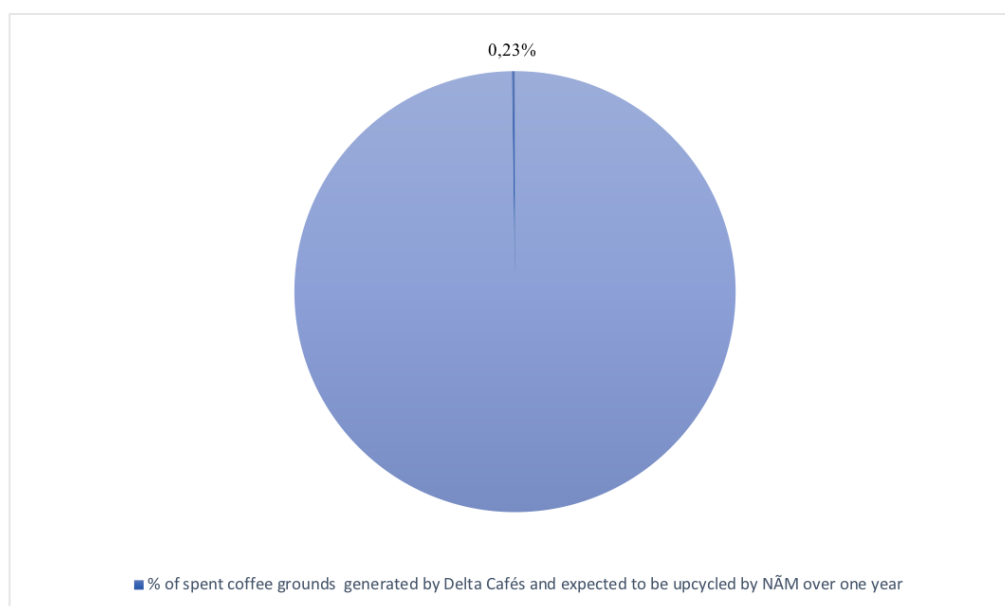
over one year and with the amount of spent coffee grounds generated with the consumption of the total amount of coffee sold by Delta Cafés per year

a. Percentage of coffee waste expected to be upcycled by NÃM in one year over the total amount of spent coffee grounds annually generated in Lisbon



Source: Authors

b. Percentage of coffee waste expected to be upcycled by NÃM in one year over the total amount of spent coffee grounds generated by the quantity of coffee sold annually by Delta Cafés.



Source: Authors

Appendix 15 List of Meetings

Date	Duration (minutes)	Topic	Type	Participants	Students
17/09/2021	75	Work Project kick-off	Online Meeting	Miguel Ribeirinho – Head of Business Development at Delta Cafés Rita Nabeiro – CEO of Grupo Nabeiro's company Adega Mayor	Caetano Xavier Mathilde Exhertier Margarida Pires Arianna Vanni Gonçalo Pereira
07/10/2021	45	Delta Cafés' overview	Online Meeting	Miguel Ribeirinho – Head of Business Development at Delta Cafés	Margarida Pires Arianna Vanni Gonçalo Pereira

28/10/2021	90	Presentation of Nãm and Delta Ventures	Class	Pedro Castro – Head of Delta Ventures Natan Jacquemin – Founder of Nãm	Caetano Xavier Mathilde Exhertier Arianna Vanni Gonçalo Pereira
2/11/2021	60	Interview about Delta Cafés' investment in Nãm	Online Meeting	Pedro Castro – Head of Delta Ventures	Margarida Pires Gonçalo Pereira
05/11/2021	120	Interview about Nãm and Visit to Nãm's farm in Marvila	Site Visit	Natan Jacquemin – Founder of Nãm	Arianna Vanni Gonçalo Pereira
12/11/2021	20	Interview about Delta Cafés and Nãm's partnership	Online Meeting	Rui Miguel Nabeiro – CEO of Delta Cafés	Arianna Vanni Margarida Pires

					Gonçalo Pereira
16/11/2021	60	Interview about Delta Cafés' partnership with NÂM	Online Meeting	Pedro Castro – Head of Delta Ventures	Margarida Pires Gonçalo Pereira
03/12/2021	60	Consultation on proposed recommendations	Online Meeting	Pedro Castro – Head of Delta Ventures	Arianna Vanni Margarida Pires Gonçalo Pereira

Source: Authors

Appendix 16 Benchmarking against coffee companies reusing spent coffee grounds

Selection of Peer Companies (Part 1)

Benchmarking against the main competitors in the Portuguese coffee market, a market that

Delta Cafés dominates

Peer Companies Group 1: Main competitors in the Portuguese market

Favourite coffee brand for home consumption in Portugal (January 2020)	Share of consumers preference	Owned by Nestlé?	Does spent coffee grounds reusing?
Delta Cafés	24,20%		X
Nespresso	11,60%	X	X
Private Labels	9,80%		X (Pingo Doce)
Sical	8,40%	X	
Buondi	8,40%	X	
Dolce Gusto	8,40%	X	X

Most consumed brands in HoReCa channel in Portugal (January 2020)	Share of consumers preference	Owned by Nestlé?	Does spent coffee grounds reusing?
Delta Cafés	64,10%		X
Buondi	14,20%	X	
Sical	5,30%	X	
Nicola Cafés	5,20%		
Lavazza	4%		
Nespresso	4%	X	X

Source: Grande Consumo (2020), and companies' reports and websites

Note: Pingo Doce is a Portuguese retailer, therefore, it was not considered.

Benchmarking against the members of International Coffee Partners (family coffee companies with similar goals and values)

Peer Companies Group 2: International Coffee Partners

ICP Members	Country of Origin	Does spent coffee grounds reusing?
Franck DD	Croatia	
Joh.Johannson Kaffe	Norway	
Lavazza	Italy	
Lofbergs Lila AB	Sweden	X
Neumann Groupe GMBH	Germany	
Paulig	Finland	X
Tchibo	Germany	X

Source: International Coffee Partners, and companies' reports and websites

Benchmarking against B-Corp certified coffee companies

Peer Group Companies 3: B-Corp

B-Corp Companies	Coutry of Origin	Does spent coffee grounds reusing?
Illy	Italy	X

Source: Certified B Corporation, and companies' reports and websites

Benchmarking against the leading coffee bar players in Europe

Peer Companies Group 4: The leading coffee bar players in Europe (by number of units) in 2019

Leading European Players	Number of Units	Country of Origin	Does spent coffee grounds reusing?
Costa Coffee	3174	UK	X
McCafé	2893	US	X
Starbucks	2813	US	X
Tchibo	869	Germany	X
Caffé Nero	849	UK	X
Coffee Like	704	Russia	
Espresso House	470	Sweeden	X
Coffee Island	454	Greece	
Gregory's	349	US	
Shokoladnitsa	330	Russia	

Source: Statista (2020), and companies' reports and websites

Benchmarking against the leading coffee roasters

Peer Companies Group 5: Top ten roasters (35% of world's coffee)

Leading coffee roasters	Coutry of Origin	European?	Does spent coffee grounds reusing?
JDE	Netherlands	X	X
Keurig	US		
Lavazza	Italy	X	
Nestlé	Switzerland	X	X
Smuckers	US		
Starbucks	US		
Strauss	Israel		
UCC	Japan		
Tchibo	Germany	X	X
Massimo Zanetti	Italy	X	

Source: Coffee Barometer (2018), and companies' reports and websites

Selection of Peer Companies (Part 2) and selection of projects

Companies that reuse SCGs	Country of Origin	P.C. Group	On Coffee Grounds Reusing	
			Initiatives in Portugal	Initiatives worldwide
Nestlé	Switzerland	1, 5	1. For fertilizer of rice fields (14)	Compost for organic farm in Singapore. 5. Biogas for electricity in Switzerland. 6. Biogas for buses in Holland. 7. Compost for rice fields in Portugal, Spain and Italy. 8. Fertilizer for school garden in Argentina. 9. Graphite for pencils
Loibergs Lila AB	Sweden	2		1. Online community to gather tips on how to reuse spent coffee grounds. 3. In the UK, collected as fertilizer and reused for furniture.
Paulig	Finland	6		1. Energy (Christmas Tree, Festival, street) 2. Research
Tchibo	Germany	2, 4, 5		1. Textiles 2. Paper
illy	Italy	3		1. Compost
Costa Coffee	UK	4		1. Fire logs for wood burners (Partnership with bio bean) 2. Flavor ingredients, raw material for other industrial applications 3. Biofuel
McCafé	US (McDonald's)	4		1. Compost in school gardens. 2. Compost for local communities
Starbucks	US	4		1. Donation of packages for fertilizer (US). 2. Compost and feed for cows (Japan). 3. Korea: composts, fertilizers, biofuel research
Caffé Nero	UK	4		1. Biomass Pellets 2. Biodiesel studied
Espresso House	Sweden	4		1. Research for Flour made from coffee grounds for baking. 2. Research for Fire logs
JDE	Netherlands	5		1. Compost

Companies that reuse SCGs	Quantity of SCGs reused in initiatives worldwide
Nestlé	3000 tons reused each year, since 2016, for biogas production in Switzerland (5.)
Loibergs Lila AB	
Paulig	3 tons reused monthly for energy production (1.)
Tchibo	
illy	
Costa Coffee	15000 tons reused, since 2016, for the production of fire logs (1.)
McCafé	
Starbucks	From 2011 to 2015, Starbucks Japan reused 1 300 tons of spent coffee grounds (260 tons per year) (2.) In 2018, 5500 tons were reused in Korea (3.)
Caffé Nero	218 tons reused since 2016 for pellets production (1.)
Espresso House	
JDE	

Companies that reuse SCGs	Fertilizer	Compost	Cattle Feeding	Bio Fuel	Coffee Grounds Reusing Mode		Furniture	Textiles	Paper	Flavor Ingredients	Raw material	Mushrooms
					Energy-Electricity	Energy-Transportation						
Nestlé	X (Enacted)	X (Enacted)		X (Enacted) (Biogas for electricity and for transportation)	X (Enacted)	X (Enacted)						
Lofbergs Lila AB	X (Enacted)						X (Enacted)					
Paulig	X (Research)	X (Research)		X (Enacted)								
Tchibo								X (Planned)	X (Enacted)			
illy		X (Enacted)										
Costa Coffee				X (Enacted) (Fire logs)						X (Enacted)	X (Enacted)	
McCafé	X (Enacted)	X (Enacted)										
Starbucks	X (Enacted)	X (Enacted)	X (Enacted)									
Caffè Nero				X (Enacted) (Biomass pellets)		X (Planned) (cars)						
Espresso House				X (Research) (Fire logs)						X (Research)		
JDE		X (Enacted)										

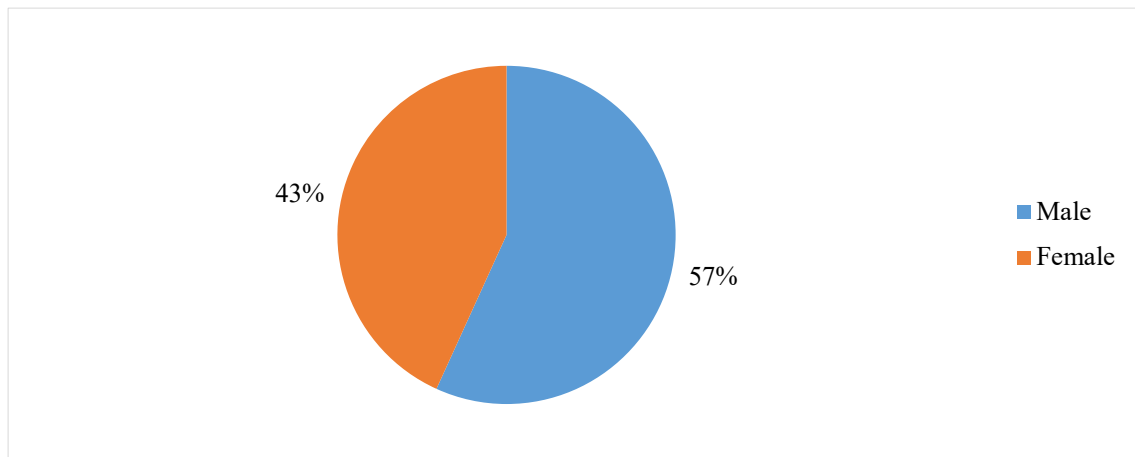
Source: Selected companies' reports and webpages

Companies that reuse SCGs	Partnerships	Relevance and selection		
		Relevant? In terms of quantity	Relevant? In terms of innovation	Selected
Nestlé	Farms (1,2,4,7); Cafeterias BAGGA and GO NATURAL supermarkets (3); Groupe E Greenwatt (5); Schools (8); Caran d'Aché (9)	X	X	X
Lofbergs Lila AB				
Paulig	The National Botanic Garden of Latvia and LLC Eco Baltia (2)		X	
Tchibo			X	
illy	Terracycle			
Costa Coffee	Bio-bean	X	X	X
McCafé	Schools (1); Local communities (2)			
Starbucks	Farms	X	X	X
Caffè Nero	Bio-bean; First Mile		X	
Espresso House	Kaffe Bueno (1); AF, the Swedish Church, Refo and RISE (2)		X	
JDE	g2 revolution			

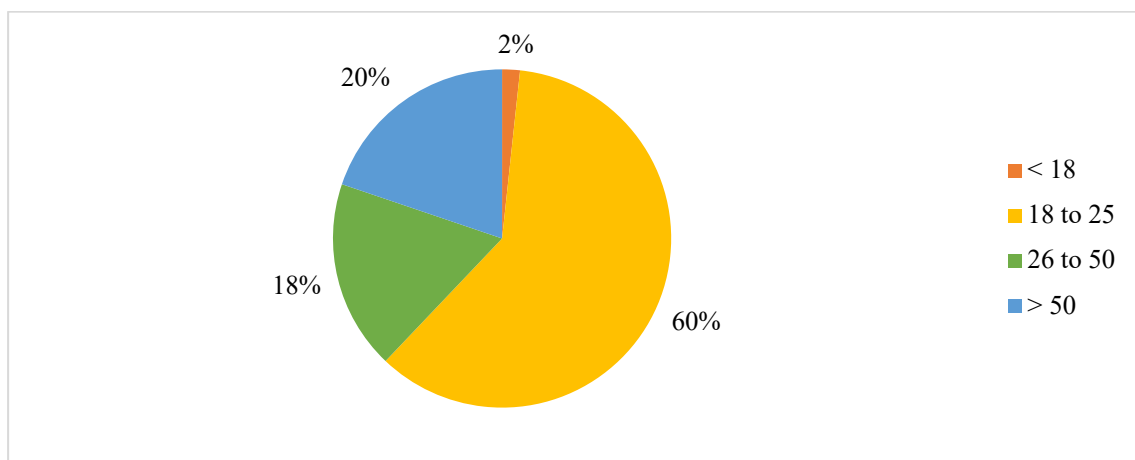
Source: Selected companies' reports and webpages, and Authors

Appendix 17 Survey “Circular economy in the coffee sector” (227 answers)

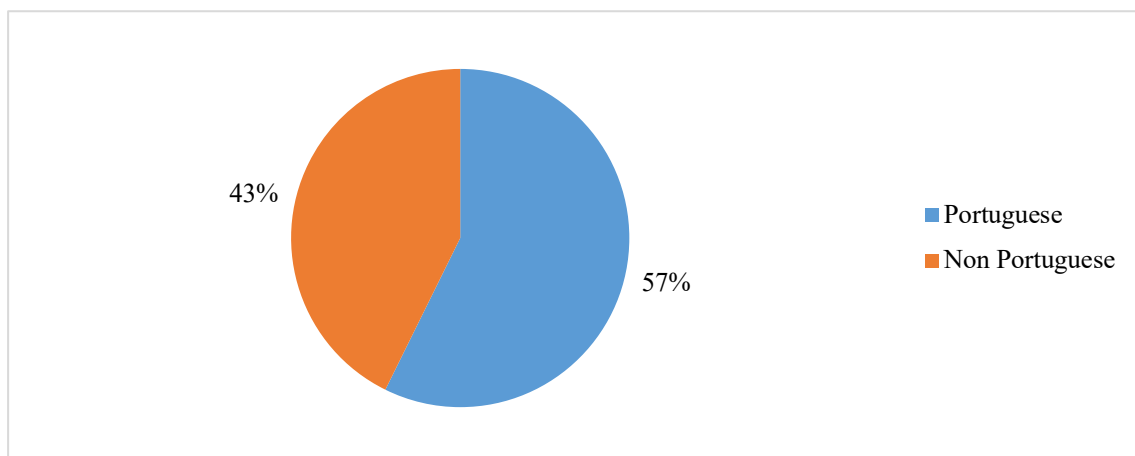
17.1. “Gender”



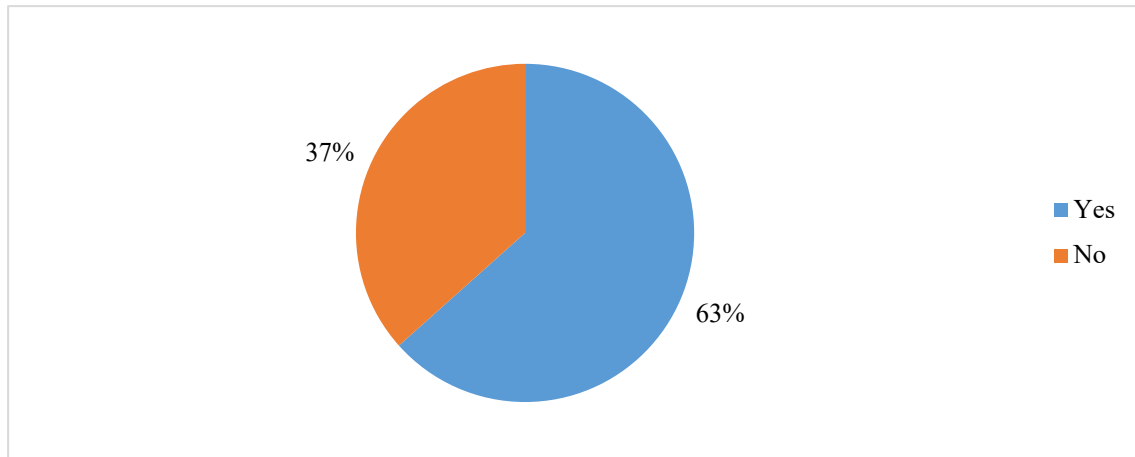
17.2 “Age”



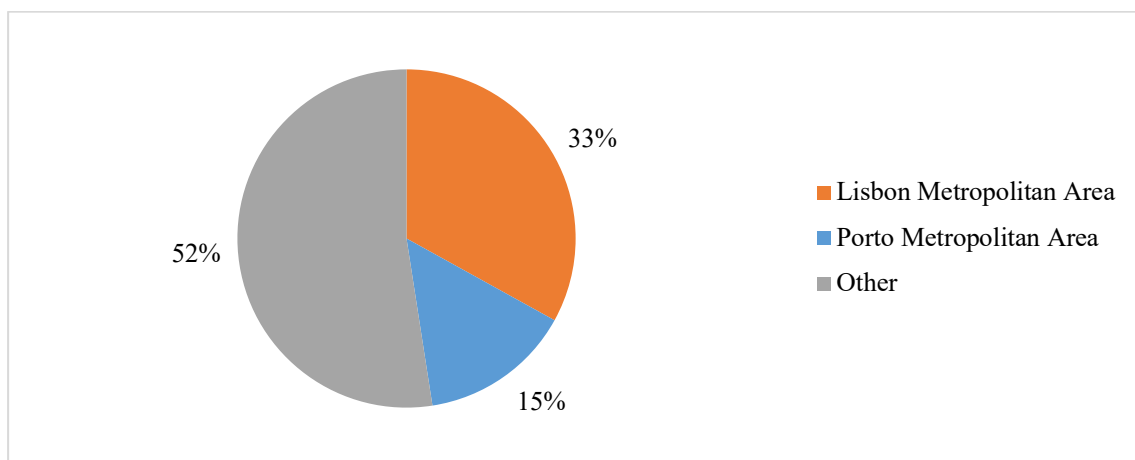
17.3 Nationality



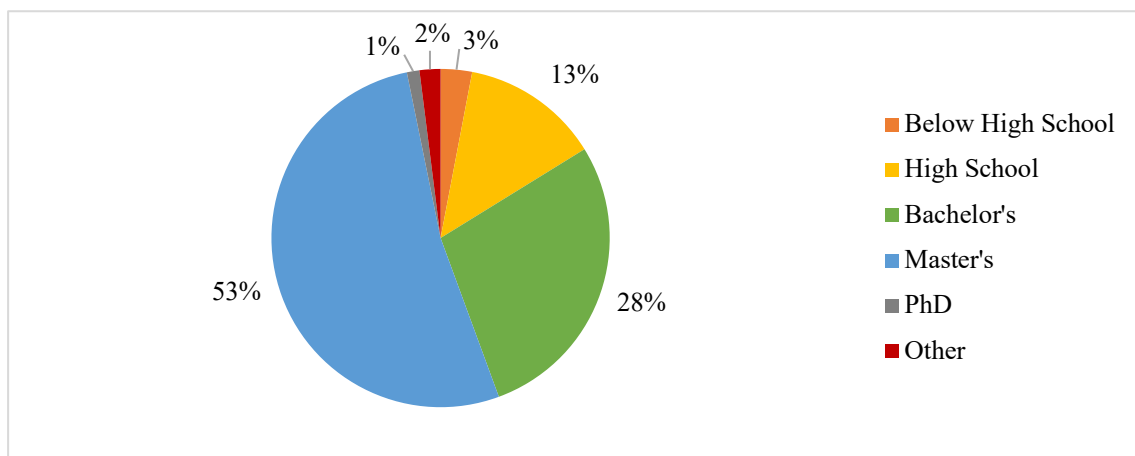
17.4 “Have you resided in Portugal for the last 12 months?”



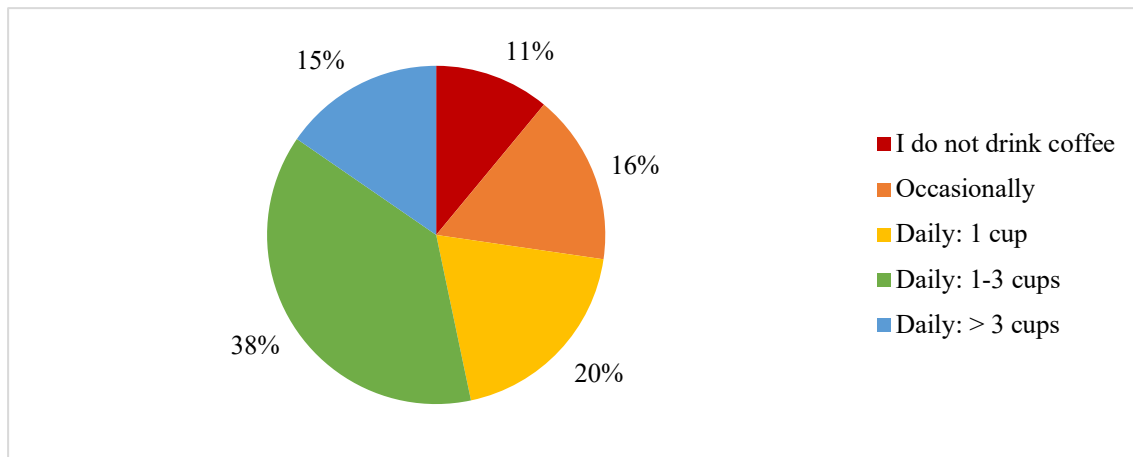
17.5 “Area of Residence”



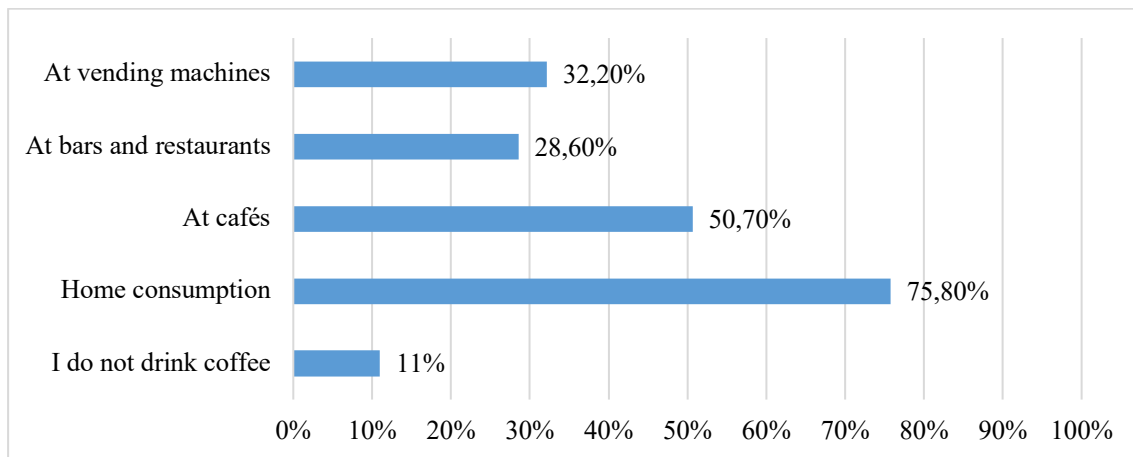
17.6 “Academic Level”



17.7 “How regularly do you drink coffee?”



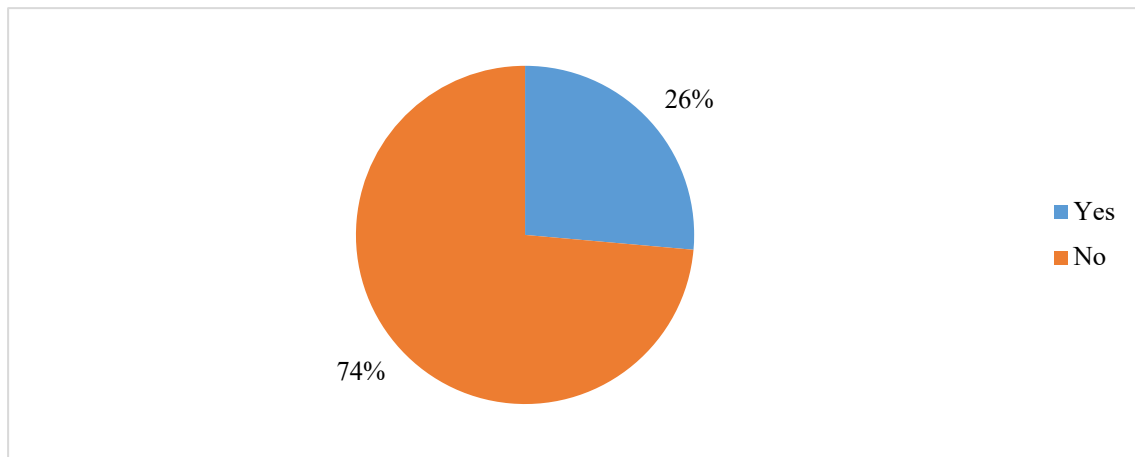
17.7.1 “If you drink coffee, what options most regularly apply to your consumption habits?”



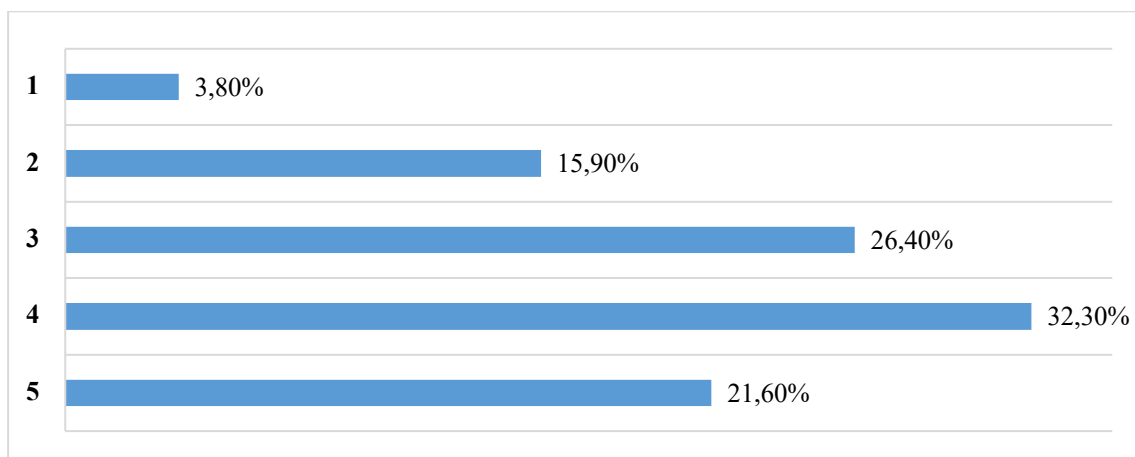
17.8 “Consumers’ perception on coffee waste”

Introduction to the section: “Less than 1% of the biomass generated by coffee production had value in the market. The other 99%, including coffee grounds, was seen as waste (Kaffe Bueno n.d.) and discarded in landfills, where it emitted significant amounts of carbon dioxide and methane, a gas 80 times more toxic than CO₂ over a 20-year period (McArthur 2021).”

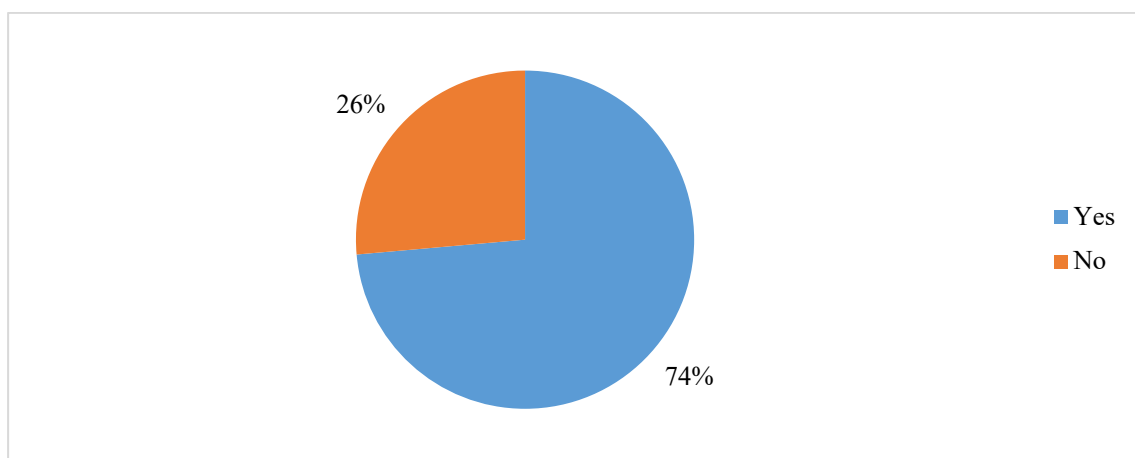
17.8.1 “Were you aware of this environmental impact?”



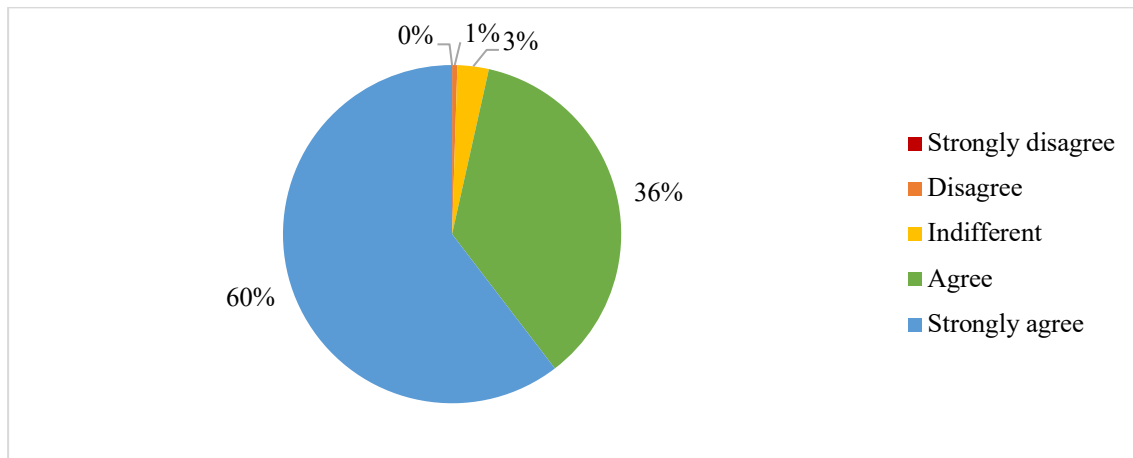
17.8.2 “On a scale from 1 to 5, how concerned are you over the impact of your own coffee consumption?”



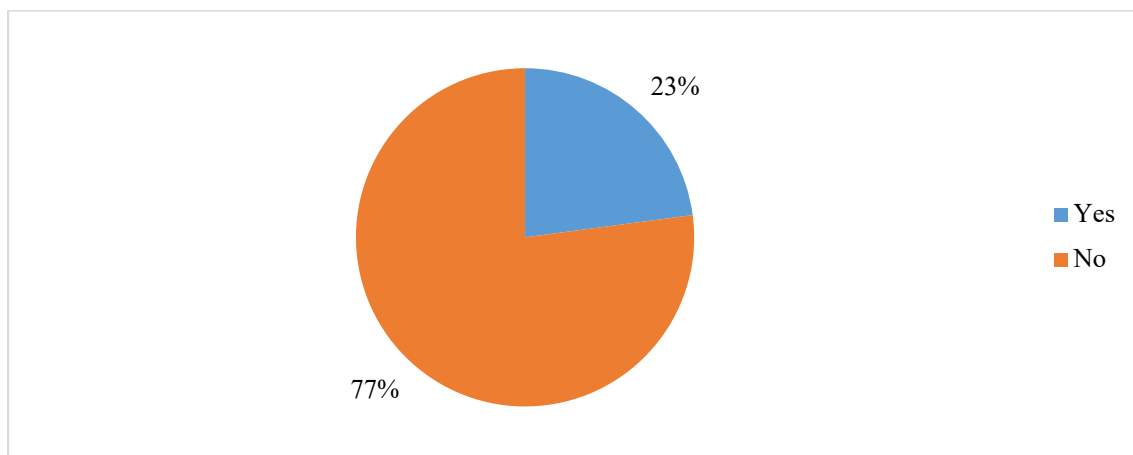
17.9 “Do you know what Circular Economy is?”



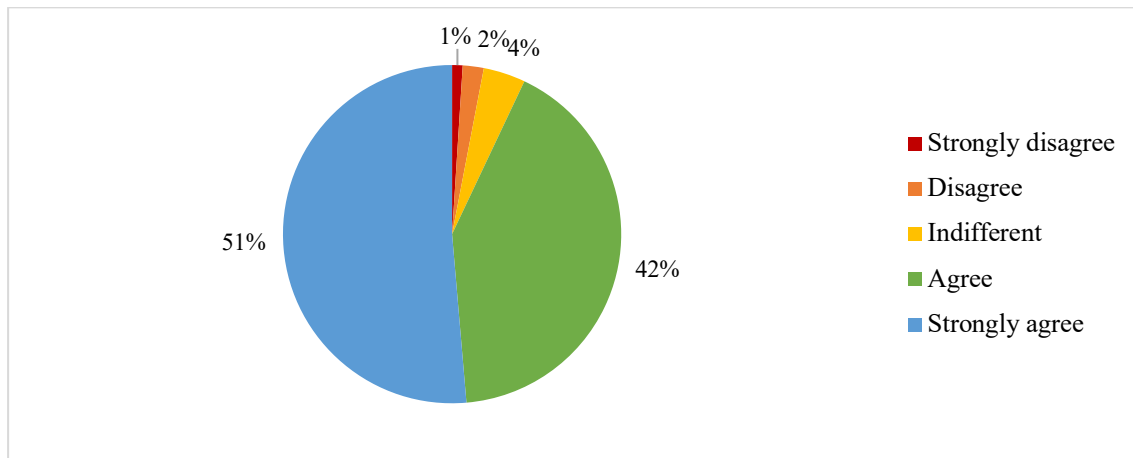
17.9.1 After knowing the definition of the circular economy: “Circular economy solutions should be a priority for businesses.”



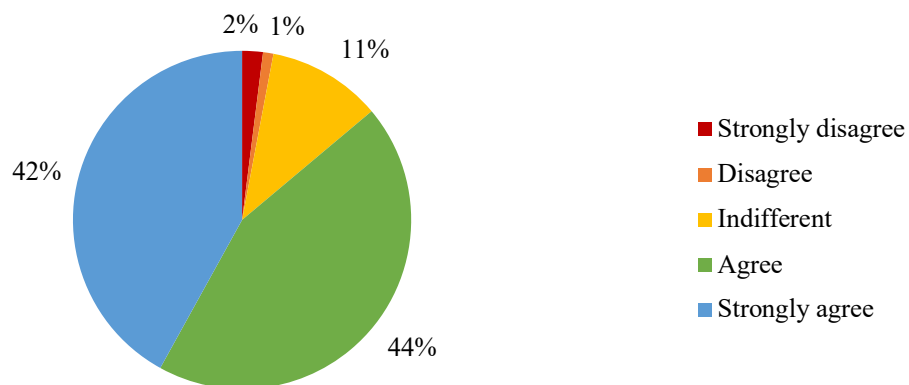
17.10 Are you aware of what the brands from which you purchase your coffee are doing to tackle the waste they generate?



17.11 “Companies in the coffee industry have a duty to find solutions to tackle the environmental impact of discarded coffee grounds.”



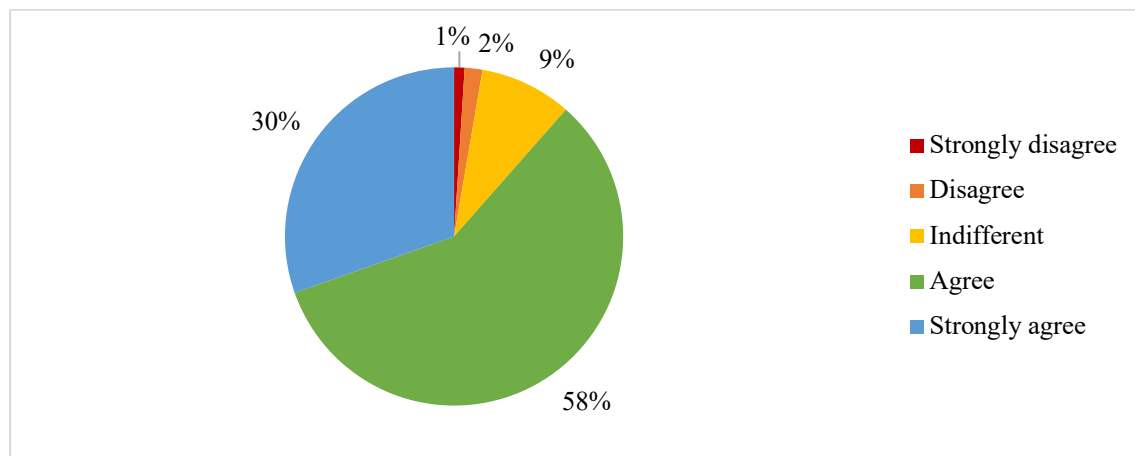
17.12 If a company in the coffee industry has a clear sustainability strategy, including a priority of minimizing waste generated by its activities, I am more willing to buy from said company.



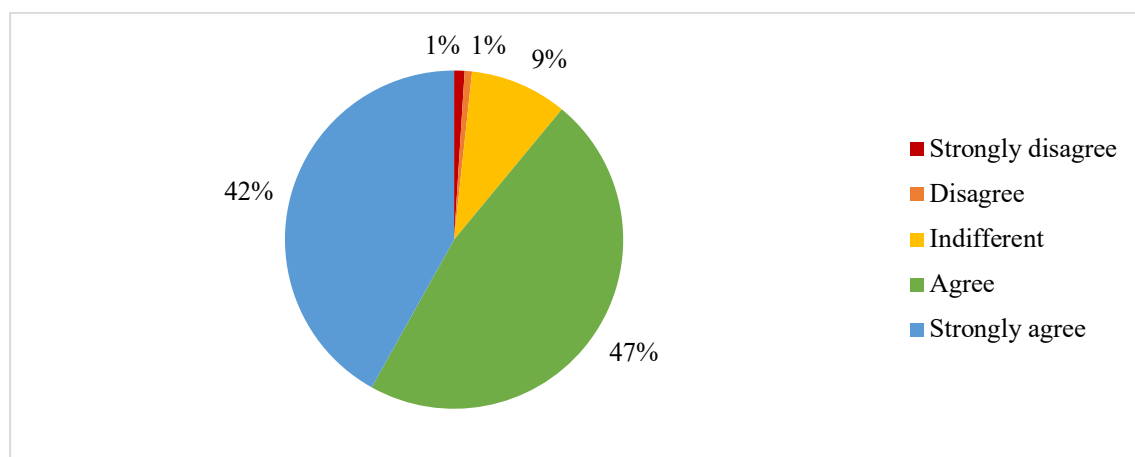
17.13 An innovative reuse of spent coffee grounds - Introduction to the section: “A Lisbon-based start-up has been reusing spent coffee grounds, which would otherwise end up in landfills, to produce delicious Oyster mushrooms in an urban farm. In this way, they reintroduce this coffee waste into the economy. The start-up supplies daily several local restaurants with these organic and fresh mushrooms. Moreover, they have delivery options for residents in Lisbon and sell DIY kits for any consumer to grow these mushrooms at home. Wanting to contribute to a

circular economy, a firm in the coffee sector has partnered with this start-up, investing in it to help its growth. The coffee brand also collects daily the spent coffee grounds from its coffee vending machines and deliver them to this urban farm. This partnership has allowed the start-up to achieve greater logistics efficiency, and increase its collection of used coffee grounds, all while reducing the coffee waste of the coffee brand. In the last year, the start-up has transformed 6 tons of coffee grounds into mushrooms per month.”

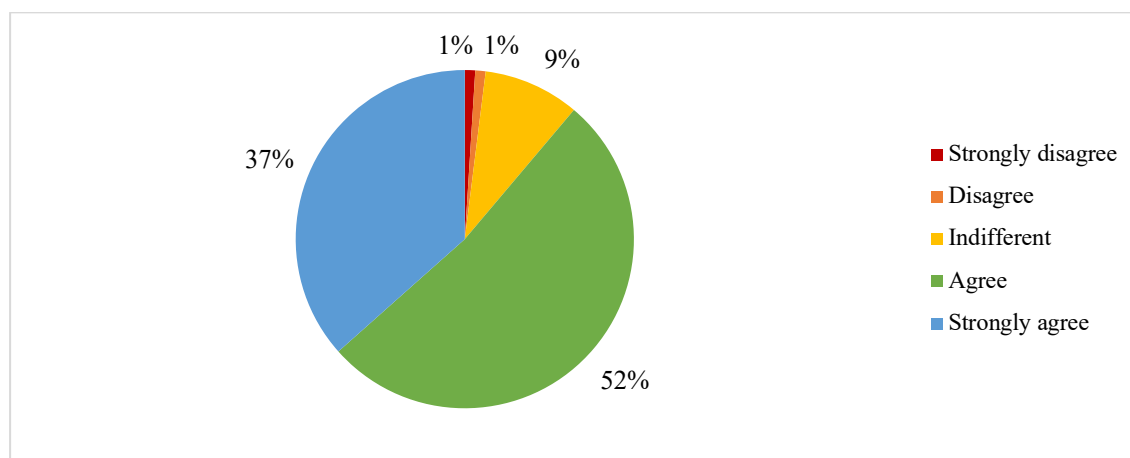
17.13.1 “Knowing of this business venture, and the coffee brand's effort to minimize coffee waste, I would be more willing to buy from this coffee brand relatively to its competitors.”



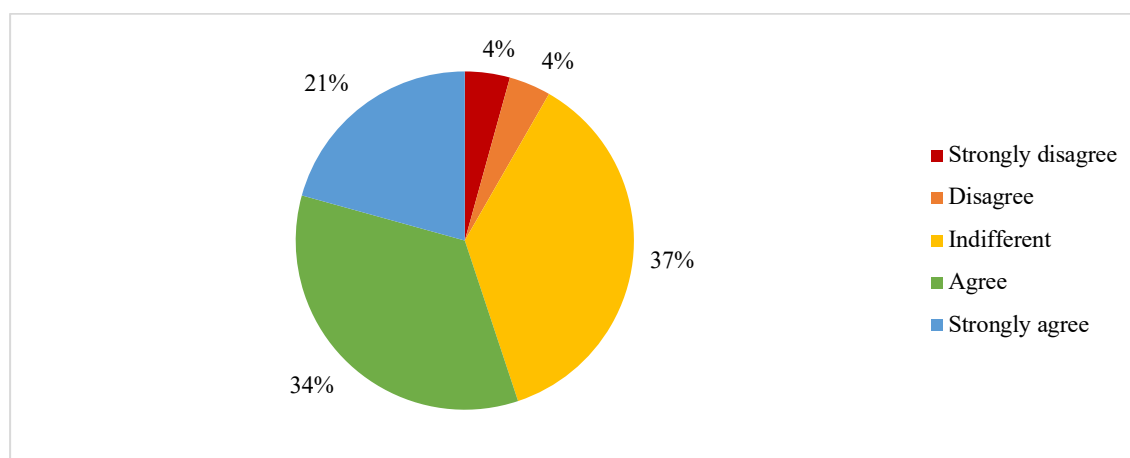
17.13.2 “Because of its effort to find solutions to the problem of spent coffee grounds through this partnership, I would hold this coffee brand in higher regard.”



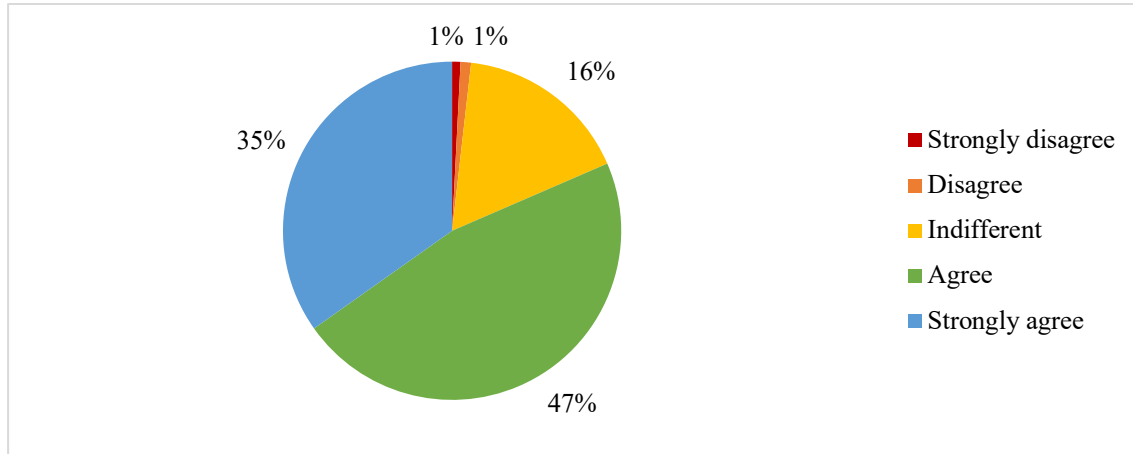
17.13.3 “Despite only being focused in the area of Lisbon, this initiative is relevant with regard to the sustainability problem posed by spent coffee grounds.”



17.13.4 “When going to a restaurant in the Lisbon area, knowing that an establishment purchases and uses a circular economy product such as these mushrooms would influence my choice of restaurant”.

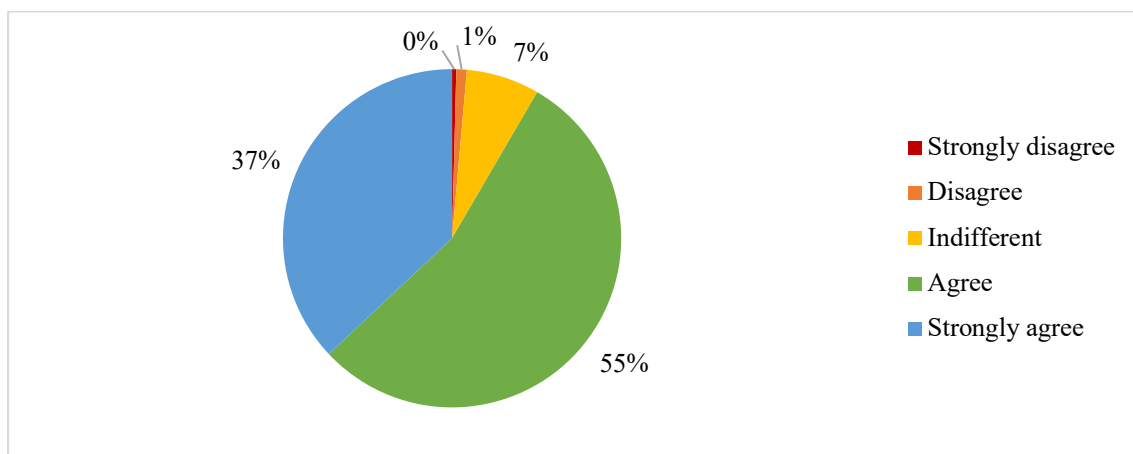


“When going to a restaurant in the Lisbon area, I would appreciate knowing that the establishment I chose to visit purchases and uses a circular economy product such as these mushrooms.”

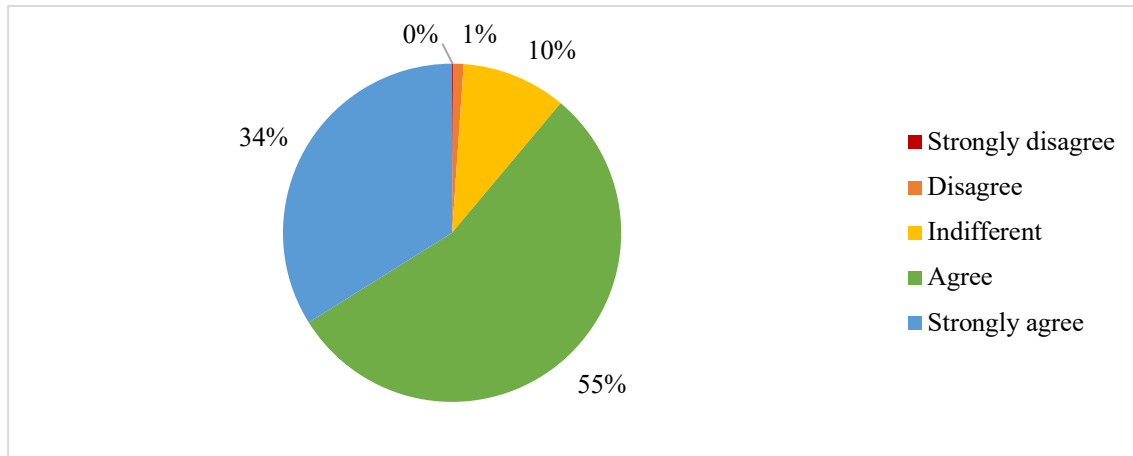


17.14 A potential scale-up - Introduction to the section: “The start-up mentioned before produces mushrooms of unmatched freshness. Therefore, restaurants eagerly buy from this urban farm. To maintain this distinguishing feature, the start-up can only serve the surrounding community so far. Onwards, please consider a potential scaling up of this urban mushroom farm, by opening more farms in other Portuguese cities or by making the products available in grocery stores, markets, and supermarkets.”

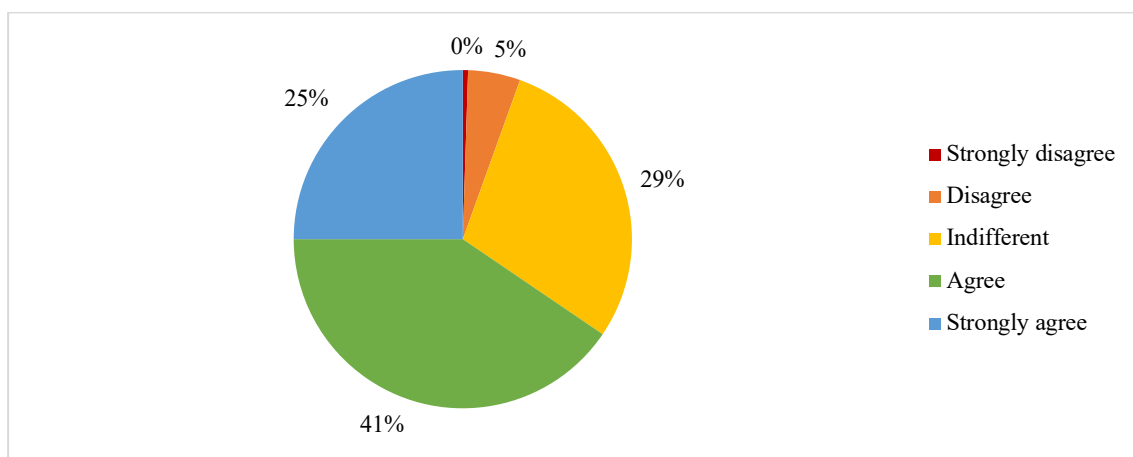
17.14.1 “The initiative would be relevant with regard to the sustainability problem posed by spent coffee grounds.”



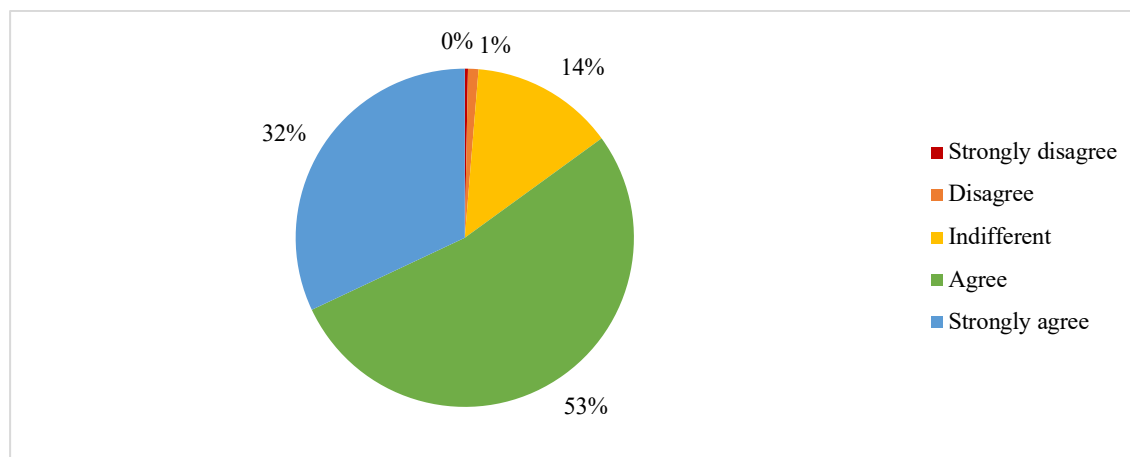
17.14.2 If it continues helping the growth of the start-up, by making resources available to scale-up the mushroom farming and to increase its impact, I would hold the aforementioned coffee brand in higher regard.



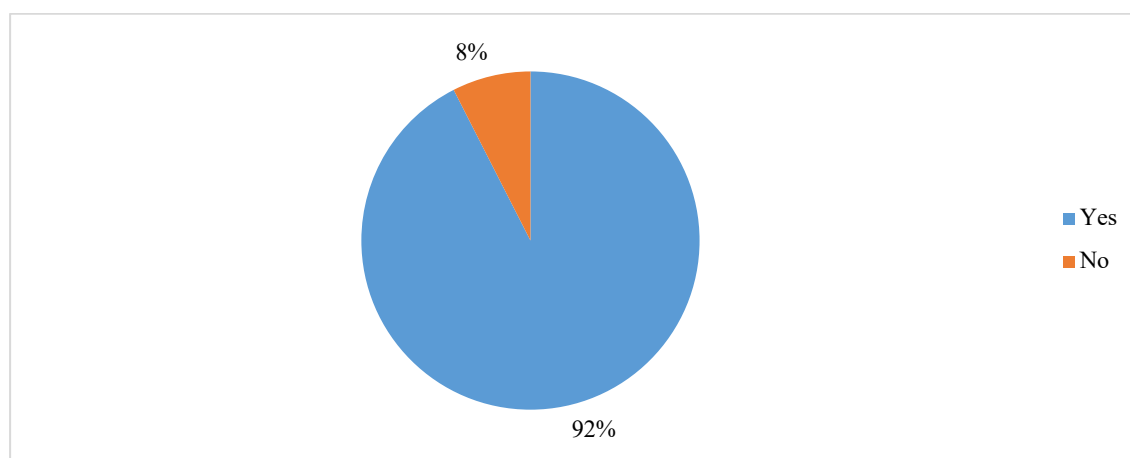
17.14.3 “When going to a restaurant in an area potentially served by this urban farm, knowing that an establishment purchases and uses a circular economy product such as these mushrooms would influence my choice of the restaurant.”



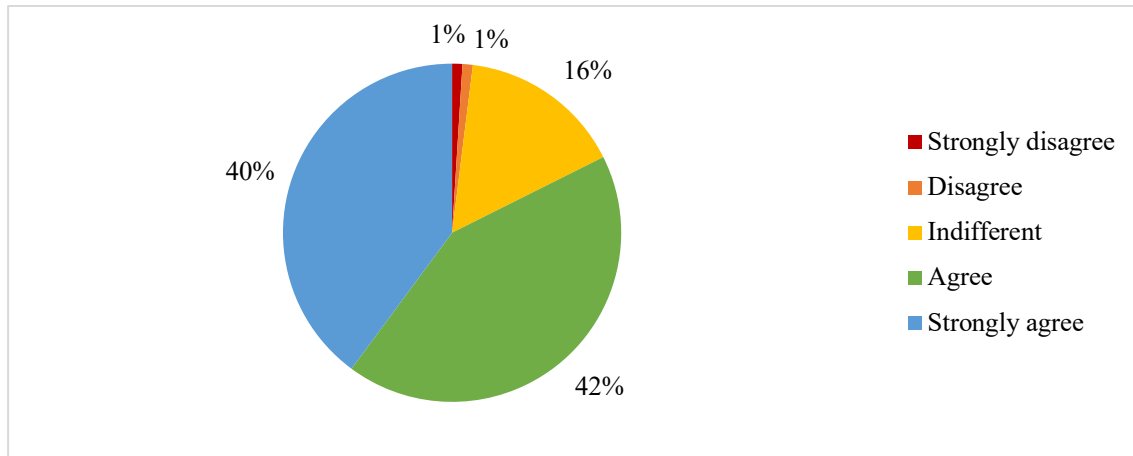
17.14.4 “When going to a restaurant in an area potentially served by this urban farm, I would appreciate knowing that the establishment I chose to visit purchases and uses a circular economy product such as these mushrooms.”



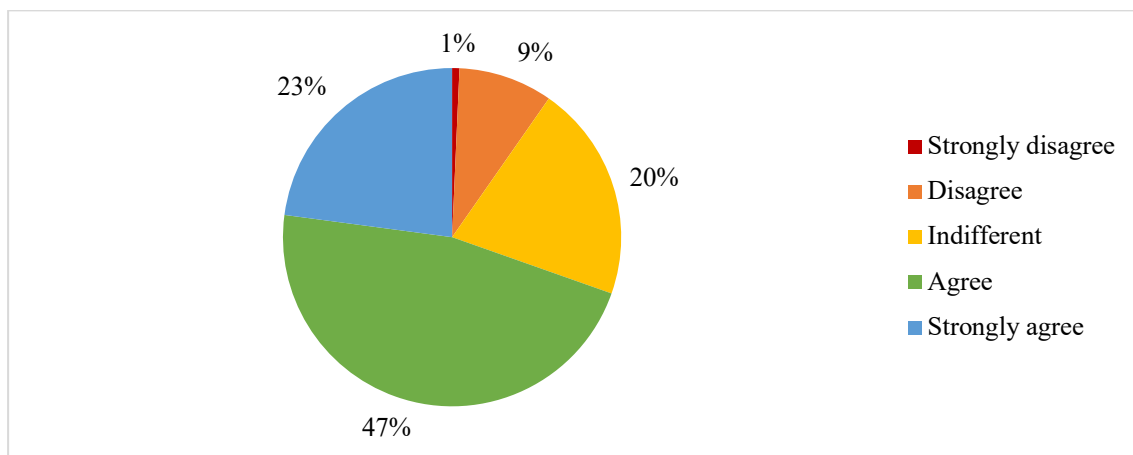
17.14.5 “Would you like to find these fresh, organic mushrooms in a grocery store or supermarket near you?”



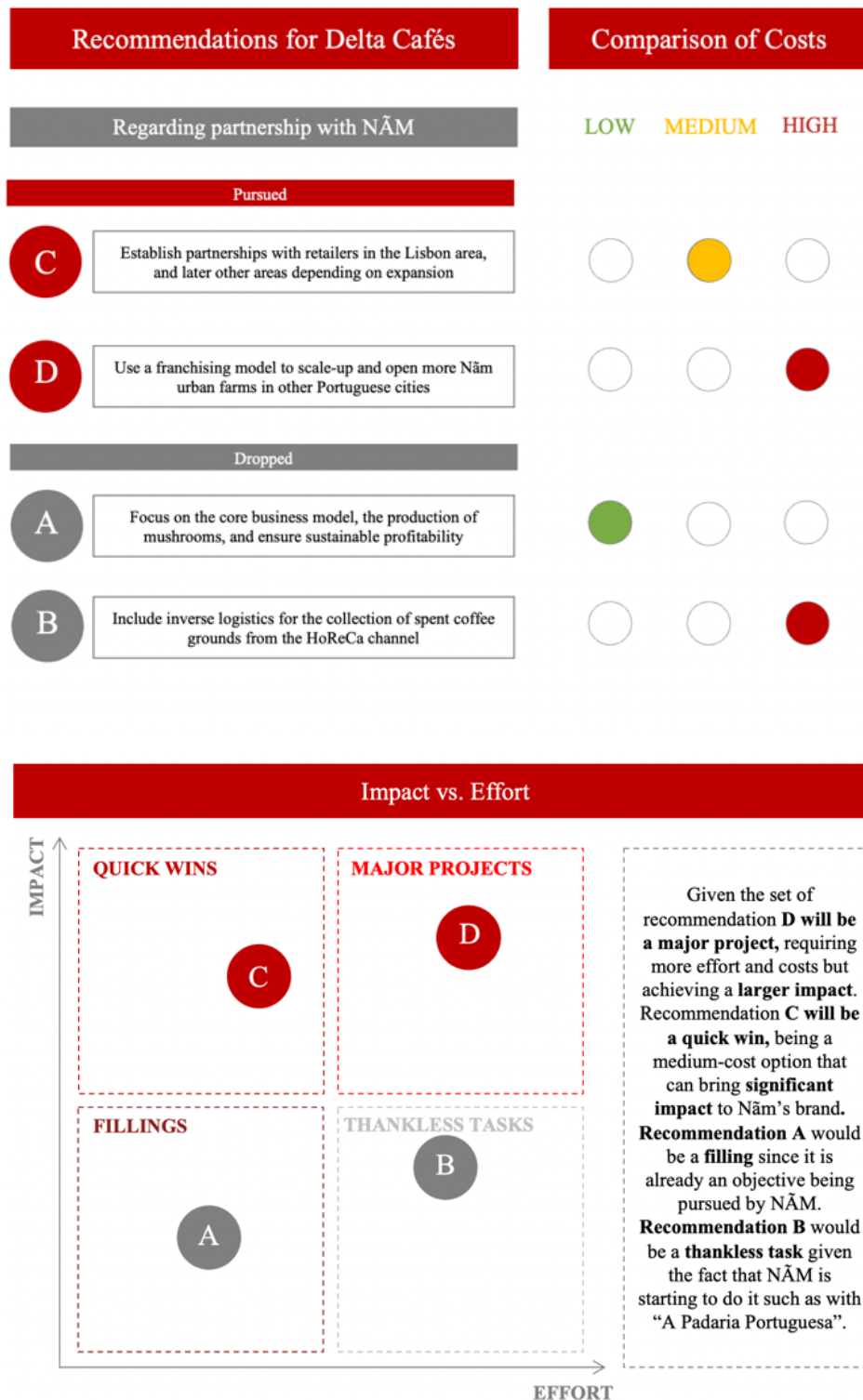
17.14.6 “Taking into account its contribution to a circular economy, if I could find these quality, fresh, organic mushrooms in a grocery store or supermarket nearby, I would prefer them to other gourmet mushrooms, if the price was comparable.”



17.14.7 “Taking into account its contribution to a circular economy, if I could find these quality, fresh, organic mushrooms in a grocery store or supermarket nearby, I would prefer them to other gourmet mushrooms, even if the price was slightly higher.”



Appendix 18 Targeted recommendations





Source: Authors

Appendix 19 Recommendation 1 – Investment in Human Resources

Job Title	Nr. Employees	Minimum wage per month	Maximum wage per month	Minimum yearly wage	Maximum yearly wage
Business Managers	2	€ 845	€ 1 581	€ 23 660	€ 44 268
Marketeers	2	€ 768	€ 1 206	€ 21 504	€ 33 768
Designers	1	€ 718	€ 1 059	€ 10 052	€ 14 826
Total	5	-	-	€ 55 216	€ 92 862

Source: Wageindicator Foundation

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