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The Cocoa Value Chain: From Nutraceutical Properties to Sustainability Issues. A Focus on Fair Trade in Italy

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Abstract: The cultivation of cocoa dates back to approximately 3000 B.C. The Mayan and Aztec populations were the first civilizations to use cocoa beans to prepare a flavored and energetic drink. In the past, chocolate was reserved for the upper strata of society and, in fact, addressed as "Food of the Gods" due to its delicacy. This cultivation arrived in Europe with the Spanish conquest of Mexico in 1519-1521 led by Hernán Cortés, and became a medical remedy used to "cure" a series of diseases. As to chocolate processing procedure, it starts from the beans, the seeds, contained inside the fruit of the cocoa plant and the production phases are as follows: fermentation and drying, roasting, grating and grinding, mixing, refining, conching and tempering. The vast majority of global cocoa bean production comes from four West African countries, i.e. Ivory Coast, Ghana, Nigeria and Cameroon. The issues related to the cultivation of cocoa and to the consequent production of chocolate currently mainly concern wild deforestation to increase plantations of cocoa, working conditions of cocoa farmers, food safety, energy efficiency of production processes as to resources and traceability of cocoa-based products. The present contribution aims, in the described scenario, at carrying an in depth analysis of these critical issues of such a strategic sector for international trade as part of the challenges to be faced to achieve the Sustainable Development Goals established by the 2030 Agenda of United Nations. In particular, a focus on fair trade in Italy is outlined with regard to the Altromercato case study.

Keywords: cocoa value chain; fair trade; chocolate; sustainable development; SDGs

1. Introduction

In the framework of the present contribution, it is fundamental to analyse the "geopolitical" issues related to the value chain at stake, i.e. the complex and multifaceted relationship between the different nodes of the same value chain.

The vast majority of cocoa-growing countries are located in the southern hemisphere. The top eight globally are Ivory Coast, Ghana, Ecuador, Cameroon, Nigeria, Brazil, Indonesia and Papua New Guinea (Pollichieni, 2023)[1]. However, as argued by the same author, despite these countries represent an essential part of a market worth almost 50 billion dollars a year, their economies show clearly to be in dire straits. Moreover, even if these countries cultivate enormous percentages of cocoa, their farms and companies are not among the world's largest chocolate producers. As a matter of fact, as will be described below, the cocoa value chain is complex and rich though unfair, as the predominant part of profits are enjoyed by companies engaged in processing cocoa and only to a little extent by small farmers in the South of the world.

The major part of the manufacturing process takes place outside the cultivation countries, thus resulting in the above cited "geopolitical" issues, with a series of consequent paradoxical results. As argued by van Vliet et al. (2021) in Ivory Coast and Ghana local farmers earn wages below the absolute poverty line (less than $1.90 a day); moreover, as above cited, the establishment of chocolate industries does not take place in cocoa-growing countries resulting in these same countries to be worn out. Growing countries face a wide series of cogent challenges also stemming from the

[1] https://www.geopop.it/la-geopolitica-del-cioccolato-un-rapporto-complesso-tra-paesi-produttori-e-consumatori/

pandemic situation and the Russia-Ukraine conflict. In order to be enabled to put in place adequate strategies aimed at facing the same challenges, these countries are increasingly demanding for higher sustainability throughout the whole value chain.

As argued by Pollichieni (2023), most of the criticisms deriving from these countries is applied to Europe as 8 of the 10 countries with the highest cocoa consumption in the world are located in this continent. Furthermore, the European Union has approved a series of regulations aimed at fighting climate change that, however, will weigh on the pockets of cocoa-growing countries. As a valid example, the Sustainable Cocoa Initiative, promoted by the European Trade Commissioner, Valdis Dombrovskis[2] aimed at enhancing cocoa production sustainability from all aspects (environmental, social and governmental), has had a poor influence on the minimum price threshold of cocoa.

The establishment of cocoa-processing industries directly in growing countries represents a solution as possible as important, though, actually, only a few isolated cases are present. As a result, cocoa and chocolate remain, on par with other goods (e.g. coffee, exotic fruits and so on) a source of conflict between the North and the South of the world.

As will analysed below, fair trade organizations play a key role in enhancing the sustainability of the value chain at stake through a series of ad hoc measures, such as, without claiming to be exhaustive, the establishment of a minimum price threshold, youth and women empowerment programmes, access to financial resources and services and a comprehensive social empowerment capable of encouraging small farmers to continuously improve and learn through dedicated on-site training.

In this framework, the present contribution aims at outlining the cocoa value chain through the different constituting nodes and the relationships (commercial, technical, social and so on) through the same nodes with a view to the importance to face the challenges related to them and to establish long-lasting cooperation and collaboration between farmers, intermediaries, retailers and final consumers. A brief focus on Italy is delineated with the aim to propose a case study of a best practice, namely Altromercato, a cooperative that, established in 1988 from the intuition of three young students of the University of Innsbruck, has gained an increasing importance in the fair trade sector so far as to become the first fair trade import centre in Italy and the second at global level. The following paragraphs of the present contribution embed a detailed analysis of the principles of Altromercato.

2. The cocoa value chain: relationships and weaknesses

In the framework of the present contribution, it is of particular interest to analyse the whole path related to cocoa and chocolate production so as to catch a glimpse of the relationships embedded in each link in the food chain. Starting from the production phase, this includes cultivation, harvesting and the post-harvest phase (fermentation and drying of seeds) to obtain cocoa beans to be used for further processing phases. Operators are represented, as mentioned, by small producers acting at a family level in the South of the world from whom the vast majority of cocoa at global level is produced. These operators retain the lowest percentage of the added value, around 6%, according to data provided by UNCTAD (Eba, 2023). As well, small farmers employ the major quota of their income to cover the purchase of inputs, thus drastically eroding profits. Moreover, a fraudulent practice is adopted by buyers with reference to manipulation of the weight of cocoa in collection centers in various countries, in order to further reduce payments to farmers. As to transport and procurement, they represent complex links in the value chain at stake as they strongly depend on the different geopolitical contexts. A key role is played by so called intermediaries engaged in simply buying and selling cocoa. This category consists essentially of two types: traders, i.e. those purchasing cocoa stocks and reselling them to grinders; brokers, i.e. those operating on the

futures market of stock exchange. This first category embeds primary traders whose task is buying large quantities of cocoa from small individual farmers, or more rarely from cooperatives, and reselling them at increased prices to second level buyers.

[2] https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1722)

In order to cover transport costs and logistical needs from rural areas to ports huge financial resources are needed; as a consequence, both small farmers (unless they join together in cooperatives) and primary traders can not afford to play a role in this phase and are forced to resell their reserves to the mentioned second level buyers, thus rarely reaching the export market. Conversely, second level buyers represent the commercially strongest intermediaries as they are constituted mainly by local trading companies controlled by international clients, i.e. international trading companies. These operators hold sites both in the country of production/export and in the first country of import; their capability to hold significant cocoa reserves in their warehouses enables them to strongly influence the definition of cocoa prices at global level on the main commodity stock exchanges. As above cited, in this link of the chain a key role is often played by brokers, purchasing cocoa not on a "physical" market, in which trading takes place with regard to the good (cocoa) already produced, but operating on a forward or cash market, in which trading concerns a good (cocoa) not yet produced. In light of this situation, financial speculation accounts for one of the elements that directly and consistently influence the poor profitability of farmers.

Starting from their base value, i.e. the price established on the London and New York stock exchanges, cocoa beans are subject to multiple intermediaries thus making it difficult to assess the percentage of profits retained by these operators. In general, it is possible to affirm that most cocoa processing companies take advantage of their significant market shares also within the trading link of the value chain; the major quota of their profits is indirect as it mostly derives from purchasing large stocks of cocoa at reduced prices with evident economies of scale.

As to the successive link, first transformation and processing, it constitutes the step related to the second phase of the production cycle. Activities range from cleaning to milling and pressing cocoa beans in order to obtain a series of semi-finished cocoa products, mostly cocoa paste and butter, nibs, cocoa powder and liquor. Operators acting in this node pertain to transformation industries, also called grinders or processing companies; a clear process has taken place in past years leading to the progressive merger between the trading and grinding segments resulting in an enormous power held by few transnational industrial groups acting at global level and controlling the vast majority of cocoa and semi-finished products placed on the market. As a consequence, the percentage retained in this segment amounts at around 6% of the overall value (Lechiara & Zaninelli, 2019). The final processing node corresponds to industrial production and distribution, with activities aimed at transforming semi-finished products into chocolate and at carrying on subsequent wholesale distribution. As known, different categories of the final product are present, ranging from industrial chocolate to "couverture" chocolate, in liquid or solid form and sold to secondary industries, using chocolate as a fundamental ingredient of their products. Actors involved are represented by chocolate manufacturing industries and food industries (including pastries, chocolatiers and bakeries). As evident, the vast majority of these industries are located in the North of the world and retain one of the highest percentage of the overall value along the chain (around 35%). Finally, the last step within the supply chain is represented by retailers engaged in packaging, marketing and sales. Actors involved include large-scale organized distribution, food shops and specialized shops. As to these latter, it is important to highlight that several renowned brands acting at global scale have progressively established dedicated stores often in big cities and metropolitan areas. The percentage obtained by this link of the chain is by far the most profitable (around 44%) of the overall value.

As a matter of fact, retailers hold the power to set prices for end consumers and, through ad hoc marketing campaigns and tools, to influence their purchase choices and behaviour. As argued by Del Prete & Samoggia (2020), several factors drive consumers behaviour and retailers, being well aware of this situation, take advantage from the possibility to offer a wide range of chocolate types that differs by type (dark, milk, white, with nuts, etc.), by category (artisanal, conventional, organic or certified fairtrade) and by origin of cocoa (depending on geographical location of plantations and cultivars), as argued, among others, by Jaimez et al. (2022). As this link of the chain is strongly dominated by large-scale distribution that, unlike small shops usually selling exclusively chocolate produced with high quality cocoa, sell both high quality and cheaper products.

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In the framework of the present analysis it is, therefore, important to highlight how, as a result of the mentioned scenario, the increasing demand for certified cocoa (fairtrade, organic, etc.) is intercepted and in some sense manipulated. Moreover, as large-scale organized distributors, through dominion of the downstream market, boost and reinforce the power of large intermediaries within the whole value chain, thus contributing to cut out small-scale manufacturers and upstream companies (IRBC Agreements, 2018). As a result of the present analysis, taking into account the unequal distribution of costs and benefits among all actors of the different nodes, it is possible to identify a series of unfairness. Small producers, in the South of the world, despite their decisive and fundamental role, retain the lowest percentage of profit due to their poor bargaining power. Far beyond half of the final price of chocolate is retained by trading companies, processors and retailers, while a minimum percentage devoted to pay cocoa from farmers.

As to the key underlying factors, as argued by Pipitone (2019) a series of causes can be identified systematically contributing to the low profitability of producers and, in the long term, to the resulting extreme poverty of all cocoa producing countries. Firstly, the mechanism of price definition of the raw material (cocoa) has been liberalized starting from the eighties. This phenomenon, on one hand, has certainly led to competition within the sector but, on the other hand, it has exposed farmers to price volatility and has caused the mentioned concentration of power along the value chain in the hands of large private companies. Being the government in each country absent with regard to a direct intervention in setting a minimum price, quota of internal purchases and exports, farmers are bound to prices imposed by buyers, thus losing the majority of the commercial value of their cocoa.

As with all raw materials, cocoa price is formed on the stock exchange, precisely New York (CSCE) and London (LIFFE) ones (The New York Stock Exchange | NYSE and London Stock Exchange homepage | London Stock Exchange) depending from a series of factors and, as above described, leaving ample room for speculation and consequent large price fluctuations, both in the long and short term (Schinaia, 2009; Libero Mondo, Equo Solidale & Sociale, 2011). It is easy to highlight how the negative impacts resulting from the described price volatility are absorbed entirely by small farmers as they can not afford to act in financial markets as large companies do, thus taking out insurance against price fluctuations or having access to protection mechanisms. A second factor worth analysing is the progressive, especially in recent decades, of the bargaining power of the intermediate links in the cocoa-chocolate value chain together with the consequent and obvious increase in their percentage of profits retained. This phenomenon is the result of both the dismantling of para-state apparatuses in those countries producing agricultural raw materials and European regulations fostering, de facto, global economic integration (de Schutter, 2014). This increasing vertical integration, witnessed by the concentration of around three quarters of the cocoa traded and processed worldwide in the hands of just eight large traders and grinders, is justified by multinationals as the best way to respond to growing consumers demand in terms of product quality and traceability. Conversely, viewed from the point of view of small producers, this situation erodes their negotiating power, trading margins and, consequently, profits all resulting in an evident asymmetry of power within the market (Pipitone, 2019). Small farmers are left with no choice but accepting the premium imposed by intermediaries as market concentration prevents them to find alternative companies to sell to. Farmers, then, result being inevitably bound by a strong dependence on traders and buyers and further weakened by limited access to financial resources and aid, market information and, above all, agricultural inputs (seeds and fertilisers).

As argued by de Schutter (2014), it is possible to ascertain a mechanism of "mutual reinforcing consolidation", as large retailers choose to purchase semi-finished products from large processing companies in order to reduce transaction costs and to draw on supplies of a wide variety of products and related packaging. As to the analysis conducted in the present contribution, it is vital to consider how fairtrade mechanisms play a fundamental role in contrasting this situation, as will further described.

Finally, the third factor is related to the structural features of rural areas located mainly in the South of the world. In all production countries farmers show a high degree of disorganisation, fragmentation and isolation as well as the lack of adequate infrastructures, production inputs and

legal access to cultivated land. This situation of diffused disorganisation fosters, as easily understandable, speculation and intermediaries power, as already described. The combined effect of not receiving adequate remuneration and limited access to financial resources to reinvest in improving the productivity of their plantations results in the absence of a growth perspective and general continuous stagnation, thus undermining a concrete development of communities. This is particularly true with reference to the value chain at stake, as the fact that it takes three years before a cocoa tree begins to bear fruit and about ten for a profitable harvest, renders the agricultural investment costly and time-consuming investment, with risks far outweighing profit opportunities. As a result, rural production areas face a serious depopulation and demographic impoverishment as young people, no longer seeing cocoa as their "future", choose to migrate. The average age of cocoa producers results to be dramatically high thus putting an additional element of pressure, and a challenge, on the sustainability of the entire sector (World Bank, 2015; UNCTAD, 2016).

All the plethora of programmes, at different levels and of different nature (public, private or mixed), focusing on the improvement of agricultural productivity and cocoa quality, as well as on crop diversification prove to be not sufficient to address these issues. Higher product quality and productivity combined with the possibility to diversify crops and devote time to other activities (e.g. livestock farming), thus mitigating the impact of price volatility, result to be important though not sufficient to guarantee a minimum income to farmers and, above all, not without difficulties in the implementation phases. As a matter of fact, an increase in crop yield is not necessarily connected with higher profits and/or a strengthening of the negotiating power of farmers; conversely, crop yields increase could indeed correspond to a surplus in cocoa production, with the consequent dramatic collapse of prices and a strengthening of the dependence of producers on intermediaries. As a result, with regard to the theme at stake in the present contribution, a vital role is played by fostering the introduction of a minimum price, in order to take into account the real value of the product and the effort made by small producers, together with supporting the creation of cooperatives. Bearing in mind the long term objective to break the bonds of subordination and dependence that binds small farmers to all the cited commercially stronger actors, ad hoc synergies need to be put in place to achieve self-sufficiency in terms of crops planning, production and marketing so as to effectively promote economic and social sustainability and concrete development. Fairtrade is, in the described framework, a fundamental tool to contribute to food sovereignty conceived as the promotion of a production, commercial and organizational model capable of placing small producers at the core of the whole value chain.

3. The effect of fair trade

As argued by a series of research studies (Krauss and Barrientos, 2021; Knößlsdorfer et al., 2021; Dragusanu et al., 2014) fairtrade plays a vital role in the context of development policies at different scales, as it embeds multiple benefits, both direct and indirect.

As to the former, it is important to mention the establishment of a minimum price threshold, as above cited, with the consequent increase in incomes and in the economic resilience of small producers. As to the latter, natural result of the direct ones, fairtrade encourages ad hoc investments in innovative agricultural methods as well as in community projects to the further benefit of the environment and of the fight to climate change, of social development and youth and female emancipation.

Focusing firstly on the issue of climate change, topical as ever, fairtrade principles foster the adoption of ecological and sustainable cultivation methods (e.g. organic) aimed at contributing to adaptation to and mitigation of climate change effects. The precious possibility, as above cited, to create cooperatives among small farmers enables them to conduct ad hoc training courses to increase awareness on these themes, involving especially young people and women farmers. Moreover, being farmers "stronger" as a result of taking part in cooperatives and through their increased credibility and liability (Krauss and Barrientos, 2021), they enlarge opportunities to put in place measures, such as

reforestation and agroforestry, to increase soil fertility and reduce the vulnerability of production systems (Fairtrade International, 2021; Fairtrade International, 2022; Dragusanu et al., 2014; Oya, Schaefer, & Skalidou, 2018).

Furthermore, the relative fair trade certification allows producers to gain easier access to financial services and resources, such as credits and advance financing (Dragusanu et al., 2014). As well, the presence of long-term trade agreements, guaranteed by intermediaries in this sector, enables producers to engage in long term sustainability programmes, carried on by the mentioned cooperatives, embedding evident social and economic benefits alongside the environmental ones. It is important to cite, without claiming to be exhaustive, young people and women empowerment and increased turnover, implementation of sustainable agricultural production methods (above all organic), attainmemt of economies of scale and of improved market access (Fairtrade International, 2021). As to the first objective above mentioned, it is worth to point out that, a several structural obstacles prevent women to actively participating in development path at local level, such as, the impossibility in certain countries to join producers cooperatives as a result of laws that hinder them from owning land, scarcity of technical knowledge and training, poor access to financial services and resources, all combined and reinforced with gender norms that assign them merely household tasks (Fairtrade International, 2020). Fairtrade organizations, as a matter of fact and in comparison with "conventional" organizations, carry on several ad hoc programmes aimed at strengthening the representation of women, both at the level of mere participation and in management roles, thus lighting the road to significant impacts at global level (Fairtrade International, 2020). Moreover, a participatory process and transparent decision-making can contribute to gender equality (Loconto, Silva Castañeda & Jimenez, 2019, pp. 76-78), thus impacting on the society as a whole.

In fact, the possibility to receive a guaranteed minimum price threshold enables producers to effectively support social development measures with particular regard to health and education sectors (Fairtrade International, 2022).

A further aspect worth analysing, as briefly above cited, is the presence of participatory governance processes, as a determining factor for the effectiveness of fair trade paths and related investments at community level. The possibility to take active part in decision-making processes encourages higher employee engagement with evident positive impacts on democracy and resilience of food systems.

Finally, as argued by Del Prete & Samoggia (2020), a crucial role is played by consumers whose awareness of all the factors that underlie the sector at stake is necessary to foster a virtuous change in consumption patterns.

As argued by Krauss & Barrientos (2021) the presence of the fair trade certification boosts credibility and visibility of products on the market, at global level, thus embedding a high potential to influence positively purchasing consumer decisions impact. As argued by Bäthge (2016), in order to support an effective development and enlargement of the fair trade sector, a consistent change in values driving consumption habits is also necessary in order to, additionally, address the scarcity of structural framework conditions in production countries hindering further progress in living conditions of involved communities.

3.1. Principles of Altromercato

In the framework of the present contribution, as above anticipated, the case study of Altromercato is worth analysing and presenting with particular regard to founding principles (https://www.altromercato.it/), as outlined in the following table (Table 1).

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Table 1. Founding principles of Altromercato.

Principle	Description
Labour protection	The value of the centrality of the individual is adopted in working relationships, as recruitment procedures and contractual relationships are conceived in a manner compatible with workers' dignity. Transparency is guaranteed through a process that enables workers to expose situations or conditions that are particularly harmful to the dignity of each employee. As to the protection of workers' health and safety, measures are constantly adopted to safeguard and improve both of them, starting from the observation of all laws and regulations in force. Risk factors are identified and assessed and, consequently, ad hoc measures to guarantee safety and healthiness of work environments are adopted, in compliance with current legislation, as above cited, and on the basis of specific knowledge deriving from each company organization. As well, preventive and protective measures are put in place together with control systems for such measures. Finally, adequate information and training programs are provided for workers as well as sharing and consulting spaces regarding the themes at stake.
Principle of legality	Activities are carried on fully and deeply respecting community, national and regional laws and regulations. Business relationships with operators not aligned with this principle are not established even at the cost of incurring an economic loss.
Centrality of the individual	The individual is placed at the core of all activities and procedures, thus ensuring physical, phsycological and moral well-being of all those entering into direct and indirect contact with the company. The focal point and main attention are devoted to fair trade producers.
Dignity and equality	Personal dignity, privacy and personality rights are safeguarded and respected. Gender equality is pursued and fulfilled and all nationalities, cultures, religions and ethnic groups are equally represented. No discrimination, harassment or sexual, personal or other offenses are allowed and, even more, tolerated.
Transparency and fairness	Activities are carried on in full transparency so as to enable all stakeholders and operators to receive and hold complete and precise information on the activities that concern each of them. The mentioned information pertains as well the fulfillment of economic performance to be disclosed in clear and understandable terms, with the fundamental objective of allowing easy and general understanding..
Effectiveness, efficiency and economic performance	All activities are conceived and conducted according to criteria of effectiveness, efficiency and cost-effectiveness, through the optimal use of available resources as well as the elimination of waste or undue burden factors. Continuous ad hoc training is provided to operators in order to increase the professionalism of workers and volunteers at all levels. Moreover, as part of the company mission, cultural and educational initatives aimed at social integration and human promotion of citizens of marginal areas of the world are promoted and implemented. Finally, adequate professionalism is adopted by operators in line with the peculiarities of the tasks and functions performed, pursuing the maximum effort to achieve the objectives assigned and diligently carrying out the necessary in-depth and updating activities.

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Table 2. PGIs for Tunisian olive oil and SDGs.

3.2. Roadmap to achieve more sustainable PGI for EVOO value chain in Tunisia.

AAs above briefly cited, in the framework of the present research, it is of particular interest to analyse the nutraceutical properties of chocolate[3] as, taking into account both beneficials and contraindications. With reference to dark chocolate, i.e. chocolate composed of at least 45% cocoa mass, a wide array of research has proven the connection with the prevention of a series of diseases, from hypertension to depression, from cardiovascular diseases to insomnia. Furthermore, dark chocolate contributes to protect human body from so-called cardiometabolic diseases, such as type 2 diabetes and blockage of arteries, thus avoiding heart attacks (Faccinetto-Beltrán et al., 2021; Perez et al., 2020). As the Aztecs and Mayans said, deities bestowed a unique gift to mankind with the cocoa plant, as these mentioned positive effects are mainly related to the high content of polyphenols, micronutrients proven to serve to regulate and improve the general functioning of human cells through their capacity to influence deeply the root of cellular life (https://www.cioccolato-quetzal.it/it/i-polifenoli-nel-cacao-a-cosa-servono-e-come-agiscono.html). In the nature polyphenols are present in all plants as they are to be responsible for odours, colours and flavours; moreover, polyphenols represent the natural shield against pathogens and against ultraviolet radiation.

As argued by Angeles and Arribas (2016), with regard to the cocoa plant content of polyphenols, it is important to refer to the alkaloids methylxanthine and, above all, theobromine. The former has proven to stimulate the nervous system without producing addiction, rather to provide a general sense of well-being and improvement in physical performance; the latter, that recalls the scientific name of cocoa, i.e. theobroma cacao, represents a sort of "twin" of caffeine, as it combines beneficial diuretic and cardiopulmonary effects (Tan et al., 2021). A major role is, as well, played by flavonols, i.e. antioxidants present in cocoa (https://www.humanitas.it/enciclopedia/alimenti/carboidrati/cacao/). These micronutrients are concentrated in the cocoa bean, precisely in the fibres, i.e. the dry, brown part of the cocoa. A wide range of research has demonstrated the importance of these substances in modulating the reactive response of human cells thus contributing to foster their natural ability to protect themselves from excess oxygen in circulation and from free radicals, i.e. unstable molecules capable of damaging cell membranes (Cooper et al., 2008).

Moreover, through fighting oxidative stress, these vital substances contribute to prevent degenerative diseases such as multiple sclerosis, Parkinson's disease and Alzheimer's, as well as cancer and, by reducing the oxidation of lipoproteins in the blood, bad cholesterol and hypertension.

Finally, polyphenols hold fundamental endocrine functions as they prevent hyperglycemia and lower levels of glycemic production in the liver, glycemic absorption in the intestine and stimulate insulin secretion. For the above mentioned reasons, these micronutrients help fighting obesity (assumed in the right portions) as they stimulate energy consumption and fat metabolism, mainly as a result of fibers content.

Cocoa can, thus, be considered as a real and precious medicine.

As to the calories content, particularly important from those on a diet, it highly depends on the brand and composition of chocolate. Since 2003, in line with the EU directive (https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32000L0036), chocolate producers are obliged to specify the composition of chocolate on the label, so as to enable consumers to distinguish pure chocolate (produced only with cocoa butter and without added vegetable fats) from the not pure one (with the addition of vegetable fats not exceeding 5%) and, even more, from surrogates (cocoa-based products containing more than 5% vegetable fats).

[3] The analysis focuses solely on dark chocolate due to the cocoa content and related properties, i.e. chocolate obtained with at least 45% cocoa mass and 26% cocoa butter.

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4. General conclusions

It is, furthermore, of particular interest to carry on a reflection, in consideration of future research paths, with regard to the "chocolate of tomorrow" (Foreverland, the future of Chocolate from Italy - Startup Reporter); as argued also by Del Prete & Samoggia (2020), consumers are progressively showing an increasing demand for healthier products and innovative ones (Giordano et al., 2016). Different companies have already started to produce and commercialize "cocoa products" (powder, bars, cream and so on) without cocoa but with a highly similar taste compared to "normal" ones and embedding the advantage to, at least at first glance, require fewer natural resources.

Among others, at territorial level, it is possible to cite Foreverland, a foodtech startup active in Apulia region, that has managed to develop, through years of ad hoc research, a sustainable alternative to cocoa by resorting to carob.

As a matter of fact, this plant widespread through the Mediterranean area and, as to Italy, in Sicily, used to be an important alternative source of sugars (precisely the pulp) and, therefore, of energy, for the populations of the same Mediterranean area, especially in periods of reduced availability of other sources (La Malfa et al., 2014). Actually, as the pulp is used almost exclusively to feed livestock, an increasing interest is devoted to seeds from which a flour known as Locust Bean Gum is extracted, highly appreciated in the food industry for its peculiarities (e.g. properties of thickening, emulsifying, stabilizing, and so on). Moreover, as carob is deemed to be a so called "super food" (Brassesco et al., 2021; Correia et al., 2018), i.e. a source of nutraceutical properties, it is of particular interest to explore the possibilities to put in place an entire value chain related to it. As to the cited alternative to chocolate, the result of ad hoc research Foreverland, the future of Chocolate from Italy - Startup Reporter) has allowed to obtain a similar product without the use of any butter, including the cocoa one.

Finally, it is important to point out that other companies and organizations, at global level, are carrying on relevant activities in the analysed direction with the aim to propose a valuable alternative to a product, chocolate, that is widely considered as being irreplaceable.

The issue at stake, at the core of the present contribution and from an ethical point of view, are numerous and are related to environmental sustainability as well as to social and cultural justice, in line with the SDGs as outlined in Table 2.

Table 2. Fair trade and SDGs.

SDG Goal	Principles of fair trade cocoa and chocolate in line with the 17 SDG Goals
	No poverty	As fair trade foresees the establishment of a minimum price threshold, small farmers receive a fair remuneration for their work and a sort of protection with regard to market instability. This situation enables them to cover production costs and guarantee the sustainability of their activities, both from an economic and social perspective, so as to achieve Goal 1, i.e. ending poverty in all its forms, everywhere.

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	Zero hunger	As a result of investments carried out by fair trade organizations (e.g. the Fairtrade International's Access Fund that has provided more than $128 million, benefiting 252,000 small farmers in 18 countries. Incofin FAF), the achievement of food security and safety and the promotion of sustainable agriculture are fostered. Fair trade organizations, as well, provide technical support and training to small producers and training.
	Gender equality	As above described, fair trade programmes embed a strong attention to young people and women empowerment. Gender equality and self-determination is at the core of these programmes as well as the fight to gender discrimination, sexual harassment and violence. Moreover, fundamental rights are safeguarded, such as maternity leave during pregnancy and breastfeeding.
	Decent work and economic growth	As far as this Goal is concerned, fair trade organizations guarantee the setting up of adequate working standards and conditions with particular regard to working hours, contract terms, labour rights such as strike and freedom of association. Moreover, safety measures are constantly adopted, such as the use of protective equipment, also against hazardous materials, facility security and establishment of complaints procedures.
	Reduced inequalities	As above described, the adoption of fair trade principles contributes to the reduction of inequalities through prohibiting discrimination and promoting fairness throughout the value chain. Young people, women and migrant workers in rural communities are empowered to become actors in all the decision processes in cooperatives and plantations. As well, they are also protected in the event of gender violence and other forms of discrimination and are guaranteed a fair and decent salary.

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	Responsible consumption and production	In the fair trade methodology both ends of the value chain are involved. On one hand, responsible production is fostered through the adoption of ad hoc mentioned measures such as sustainable agriculture (e.g. organic), resources preservation, labour rights safeguard and so on. On the other hand, intermediaries are held responsible with regard to respecting the fair trade standards to receive certification. Finally, consumers are progressively becoming more aware of the importance to purchase responsively and increasingly demand for sustainable products.
	Climate action	As a matter of fact, fair trade promotes the adoption of cultivation methods in line with climate-resilient agriculture in order to contribute to protect the environment and biodiversity. Different farmers engage in rainwater harvesting, use of renewable energy sources and best practices such as organic fertilization and dynamic agroforestry.
	Peace, justice and strong institutions	The achievement of this Goal is fostered by the setting up of participatory governance, in order to establish effective, authoritative and inclusive institutions. Farmers and workers themselves, through cooperatives, play an active role in all decision-making processes thus guaranteeing democratic, transparent and inclusive standards. This is true also with regard to commercial conditions, access to credit, insurance and different financial services.
	Partnerships for the goals	As fair trade organizations gather together a large number of stakeholders (farmers and workers, cooperatives and trade unions, consumers and activists) from all over the world, it is of particular interest to mention the achievement of this Goal. Different actors play a key role in boosting the positive impact of this sector towards farmers and workers, also cooperating with governments to effectively receive their support.

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References

Angeles Maria & Arribas Martin (2016). "El chocolate", Los libros de la Catarata, CSIC, Madrid

Stefano Lechiara, Claudia Zaninelli (2019). CACAO CORRETTO, Verso una filiera equa e sostenibile: il caso Ecuador, COSPE - ManiTese

Bäthge, S. (2016). Trend- und Wirkungsstudie: Verändert der Faire Handel die Gesellschaft?. Zenodo. https://doi.org/10.5281/zenodo.163639

Bla J. Charlotte Eba, Côte d'Ivoire-Ghana cocoa cartel (COPEC): implications for price and income volatility, 14th Multi-Year Expert Meeting on Commodities and Development, United Nations Conference on Trade and Development, 09-11 October 2023, Geneva

van Vliet, J. A., Slingerland, M. A., Waarts, Y. R., & Giller, K. E. (2021). A Living Income for Cocoa Producers in Côte d'Ivoire and Ghana? *Frontiers in Sustainable Food Systems*, *5*, Article 732831. https://doi.org/10.3389/fsufs.2021.732831

Tan, T.Y.C.; Lim, X.Y.; Yeo, J.H.H.; Lee, S.W.H.; Lai, N.M. The Health Effects of Chocolate and Cocoa: A Systematic Review. Nutrients 2021, 13, 2909. https://doi.org/10.3390/nu13092909

Cooper, K., Donovan, J., Waterhouse, A., & Williamson, G. (2008). Cocoa and health: A decade of research. British Journal of Nutrition, 99(1), 1-11. doi:10.1017/S0007114507795296

https://smartfood.ieo.it/alimenti/cioccolato/ (accessed 28/11/2023)

https://www.humanitas.it/enciclopedia/alimenti/carboidrati/cacao/ (accessed 20/11/2023)

https://www.google.com/amp/s/www.grupposandonato.it/news/2021/ottobre/cioccolato-fondente-benefici/amp (accessed 30/11/2023)

Incofin FAF (accessed 02/12/2023)

Foreverland, the future of Chocolate from Italy - Startup Reporter (accessed 10/12/2023)

CREA Centro di ricerca Alimenti e Nutrizione Pagina web: https://www.crea.gov.it/alimenti-e-nutrizione e Pagina web: https://www.alimentinutrizione.it

Faccinetto-Beltrán P, Gómez-Fernández AR, Santacruz A, Jacobo-Velázquez DA. Chocolate as Carrier to Deliver Bioactive Ingredients: Current Advances and Future Perspectives. Foods. 2021 Sep 1;10(9):2065. doi: 10.3390/foods10092065. PMID: 34574174; PMCID: PMC8472086. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8472086/ (accessed 20/11/2023)

Perez M., Lopez-Yerena A., Vallverdú-Queralt A. (2020). Traceability, authenticity and sustainability of cocoa and chocolate products: a challenge for the chocolate industry, Pages 475-489 | Published online: 17 Sep 2020. Available at https://www.tandfonline.com/doi/full/10.1080/10408398.2020.1819769 (accessed 22/11/2023)

World Bank Group (2015), Review of Ecuador's Agri-Industries Global Value Chains Bottlenecks and Roadmap for Implementation (https://gvcc.duke.edu/wp-content/uploads/WorldBank_Ahmed_Hamrick_Review_Ecuador_Agri-Industries_Global_Value_Chains_2015.pdf)

http://www.cocoabarometer.org/cocoa_barometer/Download_files/2018%20Cocoa%20Barometer%20180420.pdf

https://www.nutraceuticalbusinessreview.com/news/article_page/Chocolate_sustainability_strategy_to_protect_forests/127109

Bäthge, S. (2016). Trend- und Wirkungsstudie: Verändert der Faire Handel die Gesellschaft?. Centrum für Evaluation (CEval).

Dragusanu, R., Giovannucci, D., Nunn, N. (2014). The Economics of Fair Trade. Journal of Economic Perspectives 28 (3), pp. 217-236

Fairtrade International (2022). Assessing the Impact of Fairtrade on Poverty Reduction and Economic Resilience through Rural Development.

Fairtrade International (2021). Fairtrade Climate Change Projects – Learning from Experience.

Fairtrade International (2020). Women's access, equity and empowerment: Progress and uptake of the Fairtrade gender strategy.

Loconto, A., Silva-Castañeda, L., Jimenez, A. (2019). Participatory analysis of the use and impact of the Fairtrade premium. Laboratoire Interdisciplinaire Sciences Innovations Sociétés (LISIS).

Oya, C., Schaefer, F. & Skalidou, D. (2018). The effectiveness of agricultural certification in developing countries: A systematic review. World Development, pp. 282-312. Available at https://www.sciencedirect.com/science/article/pii/S0305750X18303012

Stefano La Malfa, Sergio Currò, Adrian Bugeja Douglas, Massimiliano Brugaletta, Marco Caruso, Alessandra Gentile, Genetic diversity revealed by EST-SSR markers in carob tree (Ceratonia siliqua L.),Biochemical Systematics and Ecology,Volume 55,2014,Pages 205-211,ISSN 0305-1978,https://doi.org/10.1016/j.bse.2014.03.022.(https://www.sciencedirect.com/science/article/pii/S0305197814001082)

Simona Giordano, Maria Lisa Clodoveo, Bernardo De Gennaro, Filomena Corbo,Factors determining neophobia and neophilia with regard to new technologies applied to the food sector: A systematic review,International Journal of Gastronomy and Food Science,Volume 11,2018,Pages 1-19,ISSN 1878-450X,https://doi.org/10.1016/j.ijgfs.2017.10.001.(https://www.sciencedirect.com/science/article/pii/S1878450X17300951)

Isabel Knößlsdorfer, Jorge Sellare, Matin Qaim,Effects of Fairtrade on farm household food security and living standards: Insights from Côte d'Ivoire,Global Food Security,Volume 29,2021,100535,ISSN 2211-9124,https://doi.org/10.1016/j.gfs.2021.100535.(https://www.sciencedirect.com/science/article/pii/S2211912421000456)

Judith E. Krauss, Stephanie Barrientos,Fairtrade and beyond: Shifting dynamics in cocoa sustainability production networks,Geoforum,Volume 120,2021,Pages 186-197,ISSN 0016-7185,https://doi.org/10.1016/j.geoforum.2021.02.002.(https://www.sciencedirect.com/science/article/pii/S0016718521000452)

Pedro José Correia, Teresa Saavedra, Florinda Gama, Maria da Graça Miguel, Amarilis de Varennes, Maribela Pestana,Biologically active compounds available in Ceratonia siliqua L. grown in contrasting soils under Mediterranean climate,Scientia Horticulturae,Volume 235,2018,Pages 228-234,ISSN 0304-4238,https://doi.org/10.1016/j.scienta.2018.03.010.(https://www.sciencedirect.com/science/article/pii/S0304423818301729)

María Emilia Brassesco, Teresa R.S. Brandão, Cristina L.M. Silva, Manuela Pintado,Carob bean (Ceratonia siliqua L.): A new perspective for functional food,Trends in Food Science & Technology,Volume 114,2021,Pages 310-322,ISSN 0924-2244, https://doi.org/10.1016/j.tifs.2021.05.037. (https://www.sciencedirect.com/science/article/pii/S0924224421003745)

World's First Cocoa-Free Chocolate | WNWN Food Labs

https://www.wired.it/article/cioccolato-senza-cacao-startup-carrubba-foreverland/https://www.google.com/amp/s/www.corriere.it/pianeta2020/21_febbraio_01/cacao-non-piu-affare-soli-uomini-manda-bambini-scuola-a2ccc090-5da9-11eb-ae12-b118d8ea2872_amp.html

https://transform-italia.it/lafrica-e-lamara-economia-politica-globale-del-cioccolato/

https://greenreport.it/rubriche/non-solo-buono-con-cacao-corretto-si-coltiva-la-specie-autoctona-e-piu-pregiata-dellecuador/

https://www.dissapore.com/spesa/cioccolato-equo-e-solidale-i-limiti-delle-certificazioni-fairtrade/

Jaimez RE, Barragan L, Fernández-Niño M, Wessjohann LA, Cedeño-Garcia G, Sotomayor Cantos I, Arteaga F. Theobroma cacao L. cultivar CCN 51: a comprehensive review on origin, genetics, sensory properties, production dynamics, and physiological aspects. PeerJ. 2022 Jan 5;10:e12676. doi: 10.7717/peerj.12676. PMID: 35036091; PMCID: PMC8742540. Pp. 1-23. Available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8742540/ (accessed 30 november 2023)

IRBC Agreements, Dutch Banking Sector Agreement (2018). Cocoa Value Chain Analysis, Value Chain Working Group, SER - Sociaal-Economische Raad (Social and Economic Council), The Netherlands, July 2018. Available at IMVO Cocoa Value Chain Analysis (imvoconvenanten.nl) (accessed 02 december 2023)

The New York Stock Exchange | NYSE

Schinaia G. (2009). Speculazioni. Cacao globale, Avvenire, 24 febbraio 2009. Available at https://www.avvenire.it/mondo/pagine/cacao-globale_20090224084600977000 (accessed 28 november 2023)

Libero Mondo, Equo Solidale & Sociale (2011), Le mani sul cacao https://issuu.com/liberomondo/docs/le_mani_sul_cacao/2

La filiera del cacao equosolidale - Altromercato

https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32000L0036