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Agricultural value chains facing the biodiversity challenge: the cocoa-chocolate example

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Cocoa, along with palm oil, rubber and soy, is a food commodity that is regularly cited for its contribution to tropical deforestation. Thus, in recent years companies and governments have issued an increasing number of statements promising to transform the sector towards greater sustainability, with the ultimate goal of "zero deforestation". Most such initiatives focus exclusively on the farming techniques employed by cocoa farmers, however, given the specificity of the major cocoa cycles, it is vital to consider the impact of the cocoa/chocolate sector on biodiversity throughout the entire value chain.

This study sets out to achieve this objective, aiming to assess the risks that cocoa farming poses to biodiversity, not only through deforestation, but also at the level of cultivated plots. Key sustainability initiatives are reviewed and evaluated in relation to their theory of change.

KEY MESSAGES

The cocoa/chocolate value chain is characterised by a high concentration of processors. There has been a fourfold decrease in the number of grinding plants in Europe in recent decades, which has decreased the sector's adaptability to sustainable production's constraints, leading to the maintenance of a structural cocoa overproduction at the global level.

Biodiversity in cocoa plantations is incomparable with the biodiversity of natural forests. The cultivation of cocoa using agroforestry does not compensate for deforestation.

In West Africa, agroforestry systems are generally quite poor, and not far removed from monocultures. A phase of restorative agricultural ecosystems is therefore necessary.

"Organic" and "fair trade" labels are producing some interesting results, but they are overly reliant on world cocoa prices. In a context of global overproduction, they do not always enable the representation of a profitable alternative to conventional agriculture. Moreover, their specifications are not sufficiently precise in the relation to the fight against deforestation.

Rainforest Alliance certification includes fairly comprehensive indicators to ensure biodiversity protection, but it suffers from highly incomplete implementation, combined with standards controls that focus more on productivity and quality rather than environmental criteria.

Voluntary corporate commitments are almost exclusively based on productivity improvement. However, many studies show that agricultural intensification is not particularly effective at protecting biodiversity. The risk of deforestation therefore remains strongly associated with the potential shift of production areas to countries that still have significant forest cover.

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EXECUTIVE SUMMARY

Faced with a ceaseless rise in global demand, in addition to threats associated with climate change, the advancing age of many plantations, and the development of new diseases, cocoa production today finds itself at the centre of issues relating to deforestation and agricultural development. Over the past three years, the whole sector has engaged in a global reflection on its impact on forests, and on biodiversity issues in general. To inform current discussions and to contribute to the definition of concepts necessary for the sector's transition towards greater sustainability, a detailed examination of the entire sector appears crucial.

This study adopts the perspective of global value chains, which makes it possible to go beyond legitimate questions on the direct impacts of production methods on ecosystems, and enables questions to be raised concerning the entire sector's role in biodiversity protection. Indeed, decisions made at each stage of the processing and distribution chain for cocoa and chocolate products have an impact on the financial equilibrium of the sector, and also on the adoption of practices by various actors that are more in line or compatible with sustainability goals.

The cocoa/chocolate sector has undergone significant transformations in recent decades. Firstly, there has been a dramatic change in the actors involved, following a series of mergers/acquisitions and the disengagement of major confectionery brands from the primary processing sector (grinding). This dynamic has led to a drastic reduction in the number of actors involved in the mid-chain processing segment.

At the same time, actors from the global cereals sector have introduced new industrial practices for the transport, storage and grinding segments, leading to a drive for greater homogeneity in the cocoa bean market. This product's standardisation on the world market has been accompanied by an increase in speculation and high volatility of international prices on commodity exchanges.

Driven by world demand, since the 1970s there has been an increase in the cocoa production area, from four million hectares to more than ten. At least half of this expansion has occurred at the expense of natural forests. However, few studies have been carried out to establish cocoa's contribution to this global deforestation with any certainty.

On the other hand, the impact of cocoa farming at the local level has been very well documented. Several studies have highlighted the way that the search for rapid gains and maximum productivity during the initial years of production leads many producers to clear natural forests to obtain the "forest rent" provided by fertile soils and optimal climatic conditions.

In addition to these clearance practices, the dissemination, especially in West Africa, of so-called "full sun" cultivation practices from the 1990s has exacerbated the impact of cocoa cultivation on biodiversity by eliminating the forest cover strata in plots and also by encouraging intensive use of chemical inputs on fields.

Cocoa farming's impact on biodiversity is therefore highly dependent on the production methods used. At least five major cultivation types can be distinguished, which vary according to the level of shade and the forest cover complexity.

Of these cultivation modes, only the most complex agroforestry systems that provide considerable shade cover enable at least a partial compensation for biodiversity loss linked to the development of cocoa plantations, although without coming close to that provided by natural forest ecosystems. This model is virtually absent in West Africa, which is by far the world's largest cocoa producing region, and is found mostly in the traditional production areas of Latin America.

This observation therefore calls for an adaptation of the sustainability efforts of sectors to the geographical reality of the different production zones.

To meet these challenges, the cocoa sector has developed several strategies. The main initiatives being the use of certification (fair trade, organic, Rainforest Alliance/UTZ) and the establishment of "corporate policies", or voluntary commitments.

The analysis of these different initiatives through a theory of change assessment allows us to understand how the sector intends to respond to the challenge of sustainability.

To achieve the sector's transformation, these initiatives are based on assumptions that we have compared to actual results that are available in various studies.

Fair trade has undeniably played a pioneering role in establishing a discourse on sustainability in the agri-food sector. It has helped create real consumer awareness. This model, based on the payment of a minimum price, is however limited by the difficulty of avoiding global cocoa market fluctuations in a competitive context characterised by cocoa overproduction, including fair trade.

Another certification pioneer is the **organic movement**, which achieves good results in terms of preserving biodiversity at the level of the cocoa plot. However, the specifications pay little or no attention to the surrounding landscapes and therefore to the deforestation issue. In addition, the organic sector's economic model is strongly dependent on the existence of a specific demand from those willing to pay a significantly higher price than that of conventional products. The increase in the share of organic cocoa on the market seems to be accompanied by a decrease in the gap between the organic price and that of the conventional market.

Rainforest/UTZ certification takes a more direct approach to the risk of deforestation. However, a number of studies highlight the partial implementation of the standard's commitments. This results from plantations and companies being given the opportunity to adopt an ongoing approach to the implementation of sustainable practices. In addition, it seems plot productivity is a decisive factor in whether or not the label is granted, sometimes to the detriment of environmental criteria. This raises the question of the instrumentalisation of the label by a segment of the downstream chain for the purpose of increasing productivity.

The central role of productivity is also a characteristic of **voluntary corporate commitments**. These commitments show a general lack of coherence in their approach, due to the stacking up of commitments that are made as and when dictated by civil society campaigns on the social and environmental issues of cocoa production. As a consequence, the theory of change for such commitments relies almost exclusively on increasing productivity per hectare. In addition to neglecting certain levers for improvement, such as purchase price or the adoption of agroecological practices, this strategy is based on overly optimistic expectations in terms of productivity gains. It seems unlikely that these gains could be sufficient to address all of the sector's social and environmental challenges.

In general, all of the studied sustainability initiatives for the cocoa/chocolate sector have a common focus on production levels and the practices of cocoa farmers. These strategies do not take into account the known displacement dynamics of cocoa production zones, which are largely responsible for the deforestation linked to this crop. In this way the industry avoids the key issue of bringing about a real transformation of the entire value chain, and not just of production.

It therefore seems necessary that all stages of the value chain, including processing and production, should adapt their model to the constraints of sustainable cocoa, i.e. cocoa that is more traceable and more profitable. And also that all actors in the sector should focus on maintaining a sustainable level of demand for current production ecosystems, to avoid a cocoa production boom in new forest basins, in Central Africa for example, that would once again lead to a wave of deforestation in sensitive ecosystems.

INTRODUCTION

Cocoa (*Theobroma cacao*) is an iconic product of global consumption patterns. Much like coffee, it combines both a strong brand image and widespread consumption, at least in the European and North American markets, where almost everyone consumes cocoa in one form or another, although there are large disparities in terms of the type and quality of products consumed.

Cocoa production is exclusively located in intertropical zone countries. Originating in Central America and Brazil, the main cocoa varieties were first cultivated in Latin America and the Caribbean in the 18th and 19th centuries, before developing in sub-Saharan Africa from the beginning of the 20th century (first in São Tomé and Príncipe, then in Ghana). Production boomed in the late 1970s due to the combination of a sharp increase in demand between 1950 and 1970, and the collapse of Ghanaian production, coupled with the Ivorian government's proactive policy to encourage the establishment of new plantations, and then in Indonesia, particularly on Sulawesi, from the 1980s (Ruf, 1995).

The physical properties of chocolate (which accounts for 90% of the final use of cocoa) means that it is unable to withstand high temperatures. For this reason consumption has for a long time been confined to temperate countries, particularly in Europe and North America, which today remain the main consumer regions. This distribution of producing and consuming countries, which is similar to a number of other commodities such as bananas, sugar and cotton, has led to the emergence of a globalised market characterised by a strong South-North orientation.

Cocoa is a naturally occurring rainforest tree in the intertropical zone in South and Central America. Its cultivation areas therefore intrinsically overlap with natural tropical forest habitats, including large swathes of the planet's tropical forests. Thus, similarly to palm oil, cocoa is an agricultural product whose cultivation can threaten the protection of tropical forests, which are known to be not only the most biodiverse ecosystems on Earth, but also among the most threatened due to the rate of deforestation (IPBES, 2019. 2.2.5.2.1).

For these reasons, cocoa is at the heart of current debates on imported deforestation in Europe. Along with soy, palm oil and rubber, cocoa is one of the main agricultural commodities imported into the European market that has been identified as one of the main factors of deforestation in non-EU countries (European Commission, 2013). In France, cocoa is one of the commodities for which the french "national strategy against imported deforestation" prescribes certain measures (MTES, 2018).

Production methods adopted by cocoa growers have a direct influence on the link between production and biodiversity conservation, including but not limited to the risk of deforestation. The aim of this study is to examine how such production methods may or may not depend on the management and governance conditions of the value chain, i.e. how cocoa, then chocolate, are transported, processed, and ultimately marketed throughout the supply chain, from the producing country to the final consumer, focusing particular attention on value distribution throughout the process.

Most of the world's leading chocolate brands have committed to providing sustainable cocoa chocolate by 2020. However, while there are many studies that focus on the social and environmental impacts of cocoa production,[1] relatively few have addressed the issue from the value chain perspective and raised the question of a possible transformation of power relations in the governance of the global cocoa/chocolate market, that could produce, or at least allow to develop, the right economic, technical and social conditions for environmental and social sustainability. To consider sustainable development issues and policies at the level of a commodity such as cocoa, it is therefore

1 See for example: Kroeger A. & Haupt F. (2017); BASIC (2016); Barometer consortium (2015).

particularly essential to understand the economic landscape of its value chain, and the actions taken to improve its sustainability from a biodiversity point of view.

The first part of this study is a review of recent developments in the structure of the cocoa/chocolate sector and the state of knowledge on the link between the cocoa trade and threats to biodiversity. The second part of the study provides an overview of the main existing initiatives aimed at achieving sustainable cocoa, and how they intend to respond to the challenge of preserving biodiversity.

1. COCOA, A FOREST PRODUCT THAT BECAME A CAUSE OF DEFORESTATION

The first part of this study reviews the organisation of the cocoa/chocolate sector along the various processing and marketing stages, and examines the way that sector-specific constraints, along with the strategies of actors, have shaped the value chain to gradually transform a species of forest origin into a cause of deforestation.

1.1. Structure and recent development of the cocoa value chain

1.1.1. A very simple global market with complex mechanisms

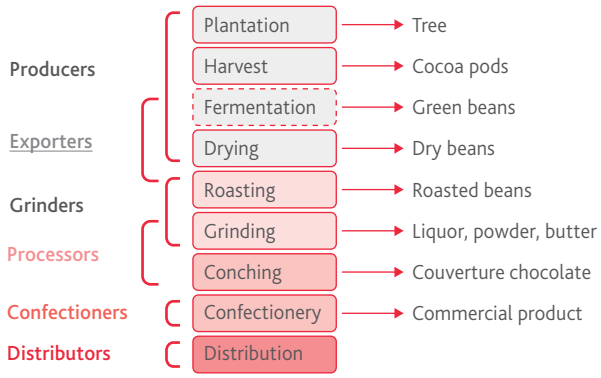
At first glance the global cocoa market seems to have a rather simple structure: a limited number of actors, a relatively uniform product with a low variety of species and products, at least until the final processing stage, and a market that is mainly organised in commodity exchanges in London and New York. These two commodity exchanges set the price for the trading of cocoa beans on the futures markets. They serve as a reference for all transactions, including over-the-counter transactions. The negotiated price is then known as the "differential" (relative to the stock exchange price).

However, this apparent simplicity hides complex mechanisms, particularly due to multiple recompositions of the supply chain and very significant speculation on the futures market and on cocoa stocks.

As illustrated in **Figure 1**, the process of transforming cocoa into chocolate involves several stages, which are almost always the same. The various actors in the supply chain divide these stages according to patterns that evolve rapidly depending on the economic opportunities, but also on the strategies of the major agribusiness groups that dominate the cocoa market (BASIC, 2016).

The Cocoa tree is an evergreen tree that can grow to between 10 and 15 metres in height. It is usually pruned at a height of 6 to 8 metres. A tree starts producing pods once it is three years old. It reaches its maximum yield at around seven years and its production begins to decline after 25 years. Cocoa pods contain several dozen beans surrounded by white pulp. Farmers grow cocoa in a variety of ways, ranging from agroforestry to monoculture full sun crops.

FIGURE 1. Cocoa and chocolate processing steps and key actors



Source: authors.

Harvest occurs between October and August[2] and is carried out by producers, their families, and sometimes employees, who pick the ripe pods. It is a very intensive process in terms of manpower, and it is not mechanised. The harvested pods are opened by hand and the seeds are collected in their pulp, known as mucilage. Depending on the region and its customs, a fermentation stage may be implemented at this point. The aim is to harness the natural anaerobic fermentation process provided by the sugar in the pulp, which transforms the aromatic balance of the beans and liquefies the mucilage. After five or sixt days, fermentation is stopped and the cocoa beans undergo a drying process. In some regions the beans are dried directly without fermentation. For example, the Dominican Republic produces both Sanchez (unfermented) and Hispaniola (fermented) quality cocoa. Fermentation is traditionally carried out at the plantations (alongside the plots) by the producers themselves. But this is by no means the only option. For example, in the Dominican Republic, other actors in the chain (exporters in this case) carry out this step at centralised fermentation facilities.

The "dry" cocoa beans, i.e. with a moisture content of around 7 or 8%, constitute the final stage of the culture and harvesting phase, and is the form in which standardised cocoa is commercialised. Next, the beans are transported from the production sites to the factories, sometimes on another continent, where the first processing step takes place. These cocoa beans are traded on commodity exchanges in London and New York. The cocoa bean price in these markets provides the reference price for the entire value chain.

2 Actual harvest periods differ from one country to another depending on the season. In Ivory Coast, for example, there is a large harvest from October to March, and a "small harvest" or intermediate harvest from April to August. The purchase price to the producer is fixed by the Coffee and Cocoa Council for each of these harvests as a percentage of the price on the export market (FOB price: Free on Board).

The cocoa beans are then transported to processing sites via various intermediaries, among which we can distinguish "local" intermediaries, which operate within a country or production zone and transport beans by road, and exporters, who sell the beans to foreign buyers.

An increasing proportion of cocoa is now processed in its country of origin prior to export: for example, Ivory Coast processes 35% of its production before export (as powder and cocoa mass), and aims to increase this to 50%. Nevertheless, the export of cocoa beans remains the norm.

The roasting of cocoa beans, crushed or not, allows the development of new aromas, and further decreases the moisture content ahead of the grinding phase. These phases are usually concomitant. The beans are ground to obtain the cocoa mass or liquor, which consists of ground beans and fat. An additional pressing step makes it possible to extract the cocoa butter, separating it from cocoa powder.

From these basic ingredients, to which others can be added (sugar, vanilla, milk...) chocolate is produced through a process known as "conching". This involves adding extra cocoa butter and sugar to the cocoa mass at a controlled temperature to obtain a specific crystallisation of the various elements. This technique produces so-called "couverture" chocolate, which is a type of consumable dark or milk chocolate that is sold wholesale to confectioners in the form of chips for use in their recipes. Some confectioners integrate the manufacture of couverture chocolate into their activities, in which case they buy cocoa beans or liquor directly. There are also companies that specialize in this process, such as Barry Callebaut (Switzerland) which has expertise in grinding and supplying couverture chocolate to leading agri-food and chocolate brands.

Finally, confectioners create products to be sold to final consumers, such as chocolate bars, biscuits, chocolate powder and cereals. It should be noted that the vast majority of cocoa is used to make products with very low cocoa percentages, such as spreads or chocolate cookies, while bars of solid chocolate are relatively limited in quantity and their sale is geographically confined to a few countries, such as Belgium, France, Switzerland and the United States (BASIC, 2016). In France, for example, 33% of the total finished chocolate products sold are solid chocolate bars, a figure that is way ahead of the European average of 5% (Xerfi, 2017).

There is often a need for transport, across varying distances, between some or all of the steps described above, which also has an impact on the power relations between actors in the value chain, according to the degree of accessibility of the cultivation areas, the transportation costs, and local regulations. The two main transport stages that structure the cocoa value chain are:

- Transport from the plantation to the warehouse prior to export, which involves two phases. The first is transportation from the plantation to the drying facilities of a cooperative or producer group. This is done by truck, motorcycle, or sometimes workers carry the loads on their backs. The next transport stage is from the drying sites to export warehouses, which are typically located on the coast. This essentially involves land transport in countries that don't have a particularly good infrastructure. The cocoa is packed in jute bags and transported by truck. Logistically, this necessitates gathering the production from several producers. The costs incurred by carriers can be significant, especially due to difficulties caused by poor road conditions, which is a particular issue during the rainy season. For these reasons, this stage of transport is rarely organised by producers or producer cooperatives. It is either coordinated by exporters, or is often the subject of significant competition between brokers and middlemen who charter trucks during the harvest season. The precariousness of producers and their need to transfer their production as quickly as possible, due to low storage capacities and the risks entailed by high humidity, makes them particularly vulnerable in negotiations with these intermediaries.
- Transport from the country of production to the country of consumption. This stage is carried out by sea in large cargo ships, or in containers. For economy of scale reasons, the harvest of many producers is pooled together. In addition, in recent decades there has been an emergence on the market of actors from the cereals sector, accompanied by the adaptation of cereal technologies to the cocoa market (bulk transport and silo storage, which are increasingly replacing bagged transport and warehouse storage) which has increased the difficulty of traceability at this stage of the supply chain (UNCTAD, 2008).

As shown in **Table 1** and **Figure 2**, there is a stark contrast in the cocoa market between producing countries, which are mainly Southern countries, and consumer countries, which are mainly from the North.

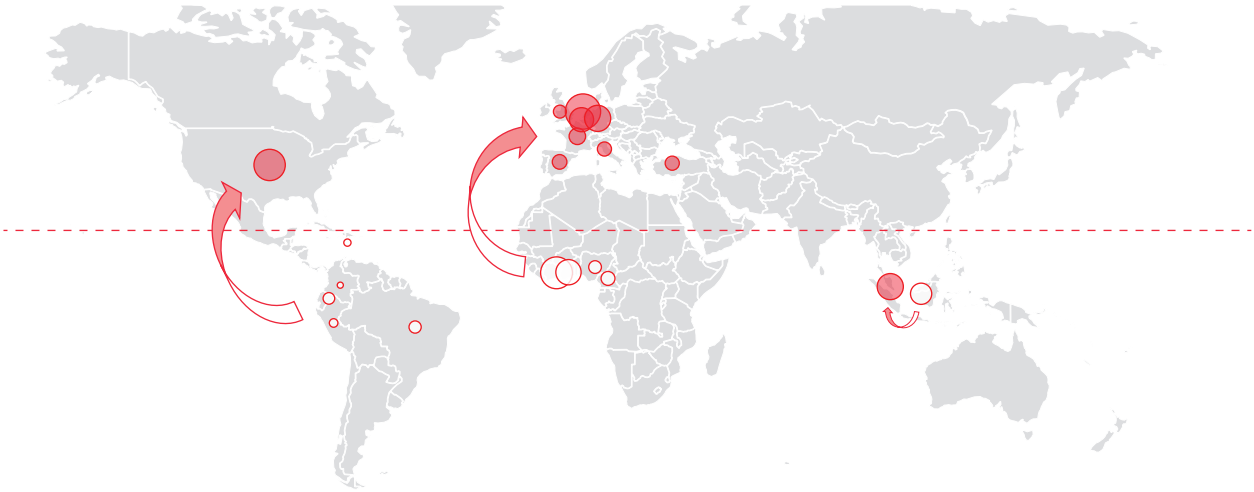
TABLE 1. Main cocoa bean producers and importers.

Ten main cocoa bean producing countries in 2016	Percentage of world production (in tonnes)	Ten main cocoa bean importing countries in 2016	Percentage of world imports (in tonnes)
Ivory Coast	33%	Netherlands	26%
Ghana	19%	Germany	13%
Indonesia	15%	United States	13%
Cameroon	7%	Belgium	9%
Nigeria	5%	Malaysia	6%
Brazil	5%	France	4%
Ecuador	4%	Spain	3%
Peru	2%	Italy	3%
Dominican Republic	2%	Turkey	3%
Colombia	1%	Singapore	3%

Source : FAOSTAT

In addition to significant economic disparities between actors in these countries, the trade asymmetry is reinforced by infrastructure inequality (road conditions, storage capacities, access

FIGURE 2. Diagram of the global flows of cocoa beans



Source: FAOSTAT.

Main producing countries Main importing countries

to port infrastructure) and access to information (telecommunication systems, access to world market information, ability for actors to communicate), which means that actors in producer countries are likely to encounter additional difficulties that weaken their negotiation positions.

The globalised nature of the cocoa market (in fact it is almost exclusively globalised because national cocoa markets are virtually non-existent), in addition to the transport and storage constraints that its marketing entails, are partly responsible for what we have labelled the "cocoa paradox". On the one hand, the cocoa sector regularly faces episodes of sudden panic caused by the announcement of short or long-term cocoa shortages: resulting from a combination of climate change impacts, declining cocoa farm productivity and ageing producer populations, which fuel the threat of a sudden and imminent decline in global production.[3] And yet, at the same time, the world cocoa bean stock is close to 42% of the global volume of cocoa ground annually (Commod Africa, 2017), which is an extremely large stock level for a food commodity. For several years the ICCO (International Cocoa Organisation) has even talked about a "structural surplus", a world market surplus that is so high that prices have plunged recently by almost 30%.

Why is there such a contradiction between the market reality and the catastrophic announcements of future shortages? This study focuses on the strategies implemented by cocoa sector actors, particularly the emphasis some of them place on productivity, to partly explain why these announcements of shortages reverberate so widely, particularly those emanating from processing companies involved in the manufacture of couverture chocolate and confectionery.

1.1.2. The cocoa value chain: quantity and uniformity attract a premium

Like other agricultural raw materials, cocoa is a "commoditised" product, as defined by Daviron and Vagneron (2011). In other words, to facilitate global market trading and to enable buyers to purchase large quantities of cocoa without having to travel to verify the quality of the goods in person, a certain number of standards have been implemented at the national market and stock exchange levels, and these standards enable buyers to fully trust the market, since the supplier's guarantee of compliance with the standards becomes a contractual obligation.

Of course, at such huge scales, with thousands of tonnes trading annually, these standards can only relate to a specific and limited set of product characteristics, which are essentially the condition of the beans and the quality of the preparation methods (fermentation and drying), to the exclusion of criteria based on taste and other aspects of production. The main consequences for the market resulting from this commoditisation are summarised by Daviron and Vagneron as follows: (1) one product sample is similar to another; (2) on the market, a sample can be easily substituted by another.

For the sector's manufacturers, this has the advantage of enabling them to find the best price in a competitive market with many different producers offering identical products (or products regarded as such), and to guarantee a continuous supply to their extremely expensive, high capacity, processing units, that they have invested in, and to which a supply disruption would represent a significant shortfall. In other words, if your usual supplier fails, it's easy to find another or even to turn towards a competitor's, to guarantee the continuity of supply to your factories.

As a result of these advantages, due to the size of the processing units in the grinding sector, it becomes impossible to distinguish the produce of different producers, or to valorize other characteristics of the product, such as organoleptic qualities, terroir or the environmental impacts of production methods (except

3 See for example: Torgemen, E. (2017) and Grisham L. (2014).

of course for high-quality marginal sectors, such as fine chocolate, and to a certain extent on the certified product market, see below). For example, the grinding facilities of Cargill, Barry Callebaut and Olam (formerly ADM) in Amsterdam/Zaanstreek are supplied directly from bulk carriers which transport up to 10,000 tonnes of cocoa (Fold, 2002). Small or medium-sized facilities, which are unable to deal with such large quantities, have to use means of transport and storage that are smaller and more expensive.

The "commoditisation" of cocoa is not a new phenomenon, with the first standards being implemented as early as 1925 (Ibid). But the phenomenon scaled up considerably in the 1990s with the arrival of new actors in the sector from the grain trade, such as Cargill and ADM, who introduced new transport and bulk storage technologies adapted from the cereals market (UNCTAD, 2008; Nienke *et al.*, 2016), as well as practices that were better adapted to supplying processing units capable of handling large quantities of produce, and allowing substantial economies of scale (Fold, 2002). In return, the very large investment required to implement these new methodologies demands the processing of larger quantities of cocoa to amortize the costs, and the system is not well adapted to shortfalls in supply. This in turn makes purchasing flexibility a necessity, reinforcing the substitutability of suppliers.

Prior to the introduction of these methods, cocoa was transported in jute bags. These bags bore the mark of the producer or carrier, and were unpacked at the first processing stage. Whereas the availability of bulk transport has led to the removal of bags so that "loose" cocoa can be transported in cargo holds and stored in silos in departure or arrival ports. This change has increased the uncertainty surrounding traceability since the produce of hundreds or even thousands of producers can be mixed together during transport and/or storage phases. As a result, this difficulty in establishing traceability makes the separation of specific sectors (organic, fair trade or controlled origin) extremely problematic, unless it is possible to process very large volumes of cocoa meeting these specifications. Ultimately, only the giants of the sector are able to provide both the required investment to process bulk cocoa, and enable the segregation of "quality" sectors; while small and medium-sized actors in the downstream sector have to rely on more expensive supply chains: purchasing cocoa in jute bags, using smaller, less automated processing facilities... Or they must instead give up on the idea of traceability and the segregation of supplies by buying couverture chocolate from the main grinders. Between the early 1990s and the early 2000s, the number of grinders in Europe decreased from 40 to less than 10.

Ultimately, to continue to benefit from the commercial advantages of certification, despite the difficulty or impossibility of supply segregation, many actors have been forced to turn to so-called "mass balance" processes, which involve ensuring that "equivalent" quantities of cocoa enter and leave the shipping and storage phases, without seeking to guarantee the exact origin of a particular product. Thus, a European buyer will pay a producer for X tonnes of certified cocoa, and will then obtain an equivalent amount from the carrier, without this cocoa being strictly separated from non-certified cocoa. This practice, which is also very common in the palm oil sector for example, is a major obstacle to the development of practices, since it encourages the coexistence of certified and conventional products within the same sector. Also, through the purchase of labelled products, consumers are unknowingly buying products from a market that is less profitable for producers and/or less respectful of the environment. This situation therefore favours the maintenance of a proportion of standardised and unlabelled production.

For cocoa, this dynamic is reinforced through the very modalities of processing, since most chocolate products can be produced from couverture chocolate, which is standardized, the manufacture of which is strongly controlled by a handful of industrial companies.

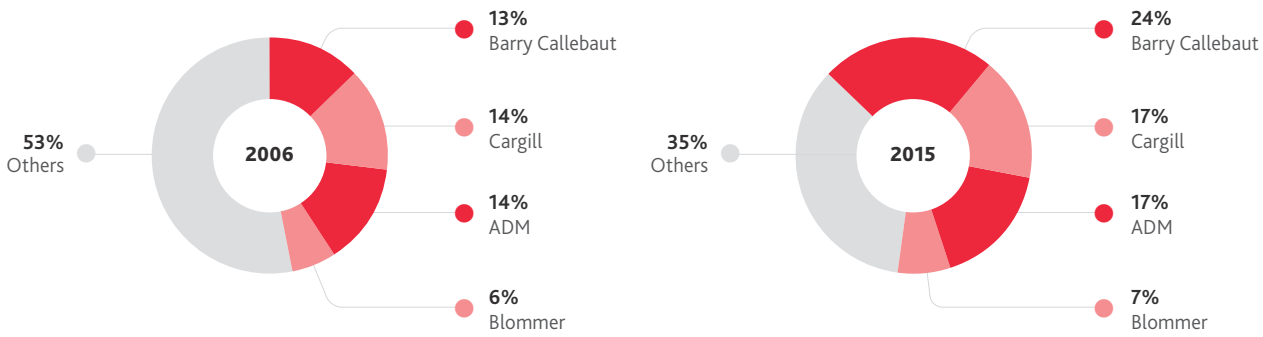
The current structure of the cocoa value chain reflects this dominance of large, capital-intensive companies. Since the beginning of the 1990s, a series of mergers/acquisitions has led to a reduction in the number of actors in the middle of the chain, but above all to a significant increase in the market share of the sector's main companies (Nienke *et al.*, 2016; Squicciarini & Swinnen, 2016). Olam's takeover of the Archer Daniels Midland cocoa business in 2015 is one of the sector's most recent significant events (Jeune Afrique, 2015). Between 2006 and 2015, the combined market share of the four main players in the grinding sector (Barry Callebaut, Cargill, ADM/Olam and Blommer) increased from 47% to 65% (**Figure 3**).[4]

The cocoa supply chain has a typical "bottleneck" shape, with over 5 million producers, most of whom cultivate a few hectares of cocoa, and millions of potential consumers downstream, with four companies in the middle of the chain that carry out two-thirds of the grinding capacity, and ten companies that share 42% of the confectionery retail trade (UNCTAD, 2016).

These elements are part of a sector in which the priority of the entire central segment, which concentrates the raw material and redistributes the processed products, is the quantity and uniformity of the product, to the detriment of a variety of tastes, and to effective segregation according to environmental and social production conditions. This means that the dominant actors in the market are unable to modify their practices, due to large investments that constrain their business models for the long term, while small and medium-sized actors are unable to obtain sufficient capital to establish competitive and transformative practices that would allow a different model to develop. In an interview with the development manager at a major cocoa company, regarding the subject of the possibility of relocating cocoa processing in the Dominican Republic, he said: "Here,

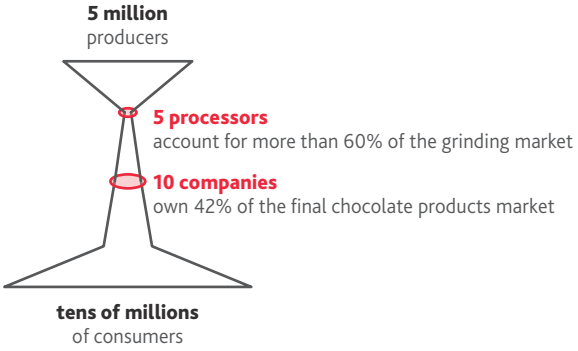
4 In a 2016 report commissioned by the Dutch Ministry of Foreign Affairs, Nienke *et al.* identified three factors that drive concentration in the cocoa processing sector: (1) economies of scale (see above); (2) economies of scope (e.g. how Cargill and Olam benefit from technologies developed for other food commodities such as cereals) and (3) agglomeration economies (the proximity of factories of different groups in Amsterdam facilitates the transport of cocoa liquor from one place to another by reducing costs).

FIGURE 3. Development of grinding market share for the main companies



Source: Nienke *et al.*, 2016 and UNCTAD, 2016.

FIGURE 4. The cocoa sector bottleneck



Source: authors.

we depend on efficiency and costs: for which we cannot afford to compete. The cost of electricity here is three times greater than in Europe. The industrial aspect cannot be separated from the market. Investment in the industry must be shared between the buyers."

A number of actors are continuing to specialize in fine chocolate or niche markets (fair trade, organic) and are managing to maintain marginal sectors at the price of significant additional costs for all operators.

1.2. Impact of cocoa production on biodiversity: an overview of the situation

1.2.1 A forest footprint that is known but poorly quantified

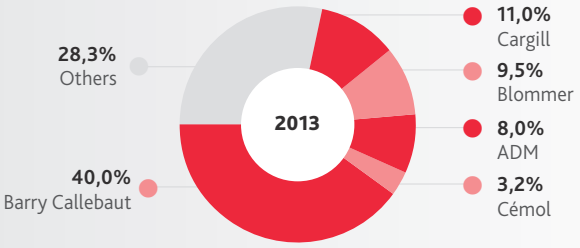
As a forest tree, cocoa thrives in climate zones where it competes with tropical forests. Although cultivation varies from low-intensity agroforestry methods to full sun monoculture (Ruf, 2011), the expansion of this crop is regularly highlighted as an important factor in deforestation (Higonnet *et al.*, 2017; European Commission, 2013). In Ivory Coast, during

THE GRINDING SECTOR: A CONCERNING LEVEL OF CONCENTRATION

The Herfindahl-Hirschman Index (HHI) is used to assess a market sector's level of concentration. It involves adding together the squared market shares of all companies in a given sector. The result is a number between 0 (perfect competition) and 10,000 (monopoly = 100% squared). It is generally estimated that an HHI below 1,000 indicates a low concentration, between 1,000 and 1,800 is a moderate level of concentration, and above 1,800 is a high level of market concentration that indicates the existence of competition problems (Nienke *et al.*, 2016).

Regarding couverture chocolate production, the HHI calculated from figures from BASIC (2016) is 1,890 (with very strong sectoral domination by Barry Callebaut, with more than 40% of the market share). We can therefore consider that the first processing stage, which is critical in the cocoa value chain, exhibits a worrying level of market concentration, and the unrivalled domination of one particular actor.

FIGURE E1. Couverture chocolate - International



studies prior to the implementation of the REDD+[5] programme, surveys conducted found that cocoa farming was cited as the main agricultural activity directly responsible for deforestation (MEDD, 2016). While the impact of cocoa farming on biodiversity is not limited to deforestation, this particular issue gives a good idea of the magnitude of the impact of production, since deforestation is directly or indirectly linked to all factors affecting biodiversity due to cocoa cultivation (pollution of soil and surface water, erosion, major reduction of plant and animal species diversity...)

Numerous studies have examined the phenomenon of local deforestation linked with cocoa cultivation and it has been firmly established that the clearance of an area of forest for the establishment of cocoa cultivation is a common and valued practice, due to the significant yields that result in the initial years of production (Ruf 1995; Bitty *et al.*, 2015; Gockowski and Sonwa 2011; Tondoh *et al.*, 2015; Leonard and Oswald 1996...). It is thus well known that forest cover in West Africa, and particularly in Ivory Coast, has been considerably reduced during recent decades, and that the remaining forests are under continuous pressure (Hackman, 2014). Some studies, such as Noble (2017), even attempt to show a link between deforestation in a given country and its rate of cocoa specialisation: the more a country relies on cocoa for exports, the higher its deforestation rate.

There is a lack of data, however, on deforestation specifically caused by cocoa cultivation at global or regional levels. Given the current state of knowledge, it is difficult to estimate the total amount of deforestation due to cocoa production in recent decades. Problems such as a lack of reliable data on land use, unresolved debates on the definition of forest areas, and difficulties in assessing cocoa expansion using satellite imagery due to similarities between agroforestry systems and closed forests, are no doubt responsible for this absence.

Nevertheless, several studies have been carried out that provide some indication of the scale of the problem. Gockowski and Sonwa (2011) focused on the West African Guinean forest and estimated, based on sampling in four countries, that cocoa cultivation led to the loss of 2.3 million hectares of forest between 1988 and 2007. Beyond these estimates, this study provides important information derived from interviews with producers regarding the nature of land use before the establishment of cocoa plantations. In Ivory Coast, for example, producers reported that in 70% of cases land was forested prior to the establishment of cocoa plantations, while in Ghana this proportion fell to 30%, with producers reporting that the majority (68%) of cocoa plantations were established on fallow land. These results highlight the need for caution when drawing general conclusions about cocoa-related deforestation, since agricultural practices, and particularly crop successions, can vary radically from one country to another.

Another study that attempted to estimate the cocoa's impact on deforestation was carried out by the European Commission in the fight against imported deforestation (European Commission, 2013). Based on FAO figures, this study aimed to estimate the global deforestation impact of various agricultural commodities imported into Europe between 1990 and 2008. It found that cocoa accounted for 8% of the continent's net imported deforestation on the European market during this period, ranking third behind soy (60%) and palm oil (12%), corresponding to an "imported" deforestation of 600,000 ha.

A Climate Focus study for the World Bank (Kroeger *et al.*, 2017) estimated that deforestation due to cocoa cultivation amounted to between 2 and 3 million hectares from 1988 to 2008, although it did not provide details of the methodology used.

These figures can be compared to those of global deforestation. Between 1990 and 2010, FAO estimated that global forest cover declined by 260 million hectares (FAOSTAT). Based on the highest estimated figure mentioned above for deforestation due to cocoa, during a comparable period (3 million ha between 1988 and 2008), we obtain a proportion of global deforestation attributable to cocoa of 1.3%.

We can also look at the 92 inter-tropical zone countries listed by FAO (Bergonzini & Lanly, 2000, p.38), where tropical deforestation for the period 1990-2010 amounted to 39.5 million hectares. Cocoa would then be responsible for 8.4% of the deforestation in this area.

This figure should be regarded with caution because the measurements used are highly uncertain. The European Commission report, for example, estimates that 24% of global deforestation during this period remains "unexplained" by their methodology. Despite this margin of error, the aforementioned points make it possible to consider cocoa as a significant source of deforestation in the tropics, while contrasting the magnitude of its impact with activities such as livestock farming and cereal cultivation for animal feed, for example.

The area under cocoa cultivation has increased from about 4 million hectares in the early 1970s to more than 10 million hectares in 2013, which has occurred at least partly to the detriment of forests. In view of this estimate, it can even be hypothesised that 50% of new plantations have been at the expense of forests.

There are two underlying dynamics at work in this expansion. Firstly, the establishment of new producers; and secondly, the extension of existing crops. These phenomena have been the subject of several studies.

In his book *Booms et crises du cacao* (1995), François Ruf gave a detailed explanation of the dynamics of inter and intra-state migration that leads to the establishment of new cocoa plantations in forest areas when the "forest rent" of previously cultivated areas has been exhausted. This dynamic has since been verified by other works. The phenomenon described by François Ruf consists of 25 to 30 year cycles that correspond to the optimum productivity of a cocoa plantation. It can be summarised as follows: when a country or region decides to invest in cocoa, its cultivation develops very rapidly and plantations are

5 Reduction of emissions from deforestation, degradation and conversion of forests. A programme by the United Nations Framework Convention on Climate Change to encourage and fund initiatives to combat deforestation and forest degradation.

established within a few years. Plantations reach peak productivity in five years, which is maintained until 10 years, at which point productivity begins to decline. When a plantation is between 25 to 30 years old, productivity drops below the profitability threshold. At which point the grower has to choose from the following options: to maintain a farm with a severely reduced income; to replace the old trees with new ones, which entails a five year break in the harvest; to move the plantation to a new area; or to convert to another crop, such as palm or rubber for example, depending on world prices.

Since all plantations in a given area tend to be of similar ages, their productivity declines at roughly the same time. This results in a widespread drop in production that reverberates on the world market. Given the ever increasing demand, new actors quickly emerge to take advantage of the gap generated as a result of the region where production has declined. When the issue arises regarding whether to renew old plantations or to create new ones in the forest, the latter option has major advantages since it gives producers the guarantee of what Ruf calls the "forest rent", which is the benefit derived from the high fertility of forest soils, which is immeasurably better than soil that has been used heavily for 25 years of cocoa cultivation.

These "displacement" dynamics of the cocoa production zone from one country to another, and also from one region to another within the same country (as in Ivory Coast for example), are a major factor accounting for the impact of cocoa production in terms of deforestation.

It therefore seems that the most significant proportion of cocoa acreage extensions at the expense of forest is made by new producers who take advantage of market opportunities to engage in cocoa production, rather than the extension of existing cropped areas.

In addition, the impact on forests and biodiversity is not solely limited to the loss of land area, but also results from a change in farmers' practices, particularly the spread of full sun cocoa cultivation techniques in the 1990s and 2000s, which are gradually replacing shade-grown crops, resulting in plantations with lower biodiversity and higher levels of soil depletion caused by drying and the use of chemical inputs (Tondoh *et al.*, 2015; Wessel and Quist-Wessel, 2015; Leonard and Oswald, 1996).

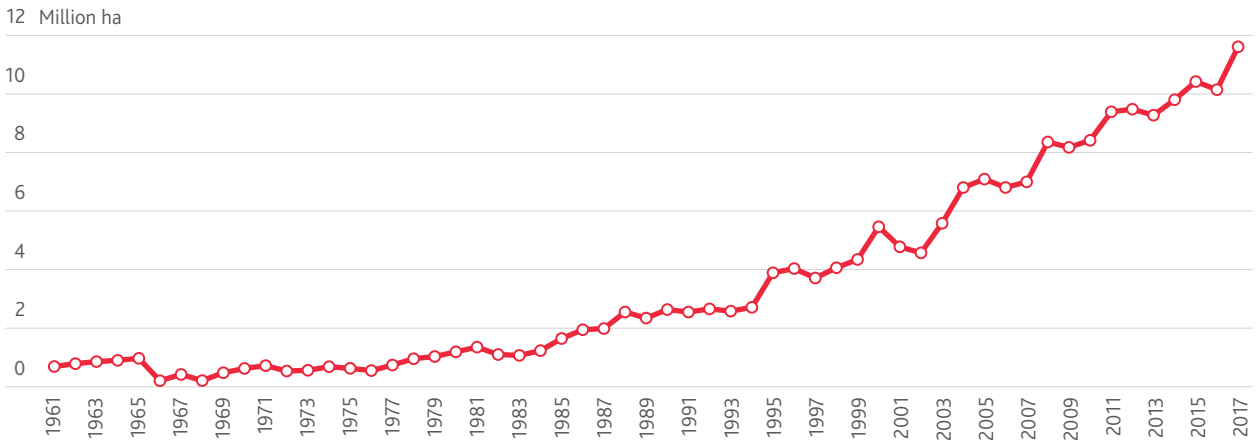
The issue of the links between biodiversity and the different methods of cocoa production must also be examined: to what extent are the different practices associated with production systems present in territories, and what is there relative importance? What impacts on biodiversity can be associated with these types of production and practices?

1.2.2. Impact of different cocoa production methods on biodiversity

In terms of biodiversity, cocoa plantations can be considered from two main angles: the conservation and protection of species within and outside of planted areas; and the emission of pollutants (via inputs). A literature search did not find any significant references on the latter issue, so this summary is necessarily limited to the former, namely the presence of trees in association with cocoa trees and cohabitation with forest areas.

From this perspective, the literature shows that systems that mix trees with cocoa can reduce impacts to varying extents as compared to a forest of high environmental value, and in comparison with other land uses, particularly other non-perennial crops: maintaining tree habitat and ecological corridors for the movement of wildlife (mitigating effects on monkeys in Nicaragua, birds in Thailand, and insects in Ecuador have thus been observed in cocoa plantations). Similarly, the combination of crops with forest cover (or agroforestry) can preserve a landscape mosaic, and thus constitute a "lesser evil" than other crops, which has been shown in Indonesia and Kenya. Finally, one mitigating effect attributed to agroforestry is the provision of income to reduce the pressure on other areas while allowing a less intensive use of land and maintaining a certain amount

FIGURE 5. Cocoa area grown worldwide



Source: FAO STAT.

of carbon per hectare, as has been highlighted in Rwanda, the Pacific, and Indonesia (Bhagwat *et al.*, 2008).

Again, from a tree density perspective, Ruf (2011) proposed an agro-economic typology of most cocoa plantations, which identifies five main types:

- full-sun production, which corresponds to a cocoa monoculture (without other trees);
- so-called simple low-shade agroforestry production, i.e. with less than ten "shade trees" (i.e. taller than cocoa trees) per hectare, with a canopy covering less than 65% of the soil (cocoa trees included). These other trees are almost always planted, usually fruit trees, and not from partially preserved natural forest;
- simple agroforestry production with medium shading, with 10 to 15 trees per hectare and a canopy that covers between 65 and 85% of the soil (cocoa trees included);
- simple agroforestry production with high shading, with at least 15 trees per hectare and a canopy covering more than 85% of the soil;
- complex agroforestry production with high shading, with more than 50 shading trees per hectare, the complex nature of which is related to the number of vegetation layers.

The link between shade and biodiversity has been the subject of a WWF analysis of relatively "complex" agroforestry types (i.e. those with several layers of forest strata, probably comparable to the above mentioned types 4 and 5). The study finds that under these conditions an area becomes close to that of "secondary" forest (i.e. fairly heavily modified by human intervention), and this type of land use in regions undergoing severe deforestation is considered a relative but distinct improvement over monocultures or pastures (Daniels, 2006).

Rice and Greenberg showed that agroforestry systems where cocoa trees are planted to "replace forest trees" ("rustic" systems), as opposed to systems where shade trees are added to a cocoa field ("planted shade" systems), possess better characteristics from a biodiversity perspective, particularly in terms of the variety of birds and mammals present (2000).

Similarly, a complex model exists in Brazil known as "Cabruca", which is obtained through the partial deforestation of primary forest and the conservation of a certain native tree density, with about 50 to 60% of tree cover, and around 70 shade trees per hectare with 700 to 800 cocoa trees. In this case the cocoa farm justifies and remunerates the conservation of forest cover, and significant biodiversity can be found here, such as the golden lion tamarin (*Leontopithecus rosalia*) and previously unknown bird species (Johns, 1999). **Figure 6** shows a graphic representation of a complex "multi-layered" system (Somarriba, 2012).

Jacobi *et al.* (2014) studied different systems in Bolivia, including a complex system which has valuable spinoffs for biodiversity, according to several research papers, especially for the conservation of soils and its ecological qualities.

In conclusion, the few available studies into the link between cocoa production systems and biodiversity confirm the view that biodiversity is greater (or least impacted) the higher the number and diversity of trees of forest origin present alongside the cocoa trees. This view is most often based on the presence of macrofauna, and less commonly on flora and soil conditions. The issue of the relative impacts of fertilizer and pesticide use, and their potential impact on downstream watersheds, has not been studied in this perspective. The remaining issue, which is the subject of the next section, is that of the analysis of the link between the practices observed in producing countries (we chose Ghana, the world's second largest producer, as an example here) and the various aspects of biodiversity. The references mentioned above suggest that this link depends on the type of forest cover associated with cocoa plantations.

FIGURE 6. Representation of "complex" cocoa agroforestry, with multiple strata

Source: Somarriba (2006).

1.2.3. Production systems in West Africa: the example of Ghana

Using the typologies provided by the literature discussed in the previous section, it seemed relevant to assess the situation of cocoa production systems in one of the main producing countries. This section is therefore based on data collected by IDDRI in Ghana in September 2018, obtained through surveys of the sector's producers and stakeholders, including intermediaries (LBCs – Licensed Buying Companies).

The areas included in the study were the Western Region, which has been Ghana's largest cocoa producing region since 1984, accounting for 51% of total production in 2017, where 21 farmers and two LBCs were surveyed; the Ashanti Region, Ghana's second largest cocoa producing region, accounting for 18% of total production in 2017, where 19 farmers, an LBC and a COCOBOD[6] representative were surveyed; the Eastern Region, Ghana's fourth largest cocoa producing region, which accounted for 10% of total production in 2017, where five organic-certified farmers were surveyed, as well as a COCOBOD representative and an LBC.

A total of 33 farmers were interviewed individually, and a focus group was conducted with 12 cocoa farmers in the Ashanti Region.

The field surveys were divided into two parts: the first consisted of structured interviews that addressed issues of yield, deforestation methods, use of chemical inputs, farm size, deforestation method and seed variety; the second part involved semi-structured interviews to ascertain the perception of farmers regarding biodiversity loss, as well as elements from a simple agrarian assessment, based on the awareness of farmers with respect to their strengths, weaknesses, opportunities and threats related to their production.

The analyses confirmed much of what experts in these regions had already known, particularly that yields were low and declining, especially for farms using "hybrid" seeds and practicing conventional (non-organic) agriculture.

The estimated yield of the farmers surveyed was 377 kg/ha in 2017, compared to an estimated 423 kg/ha in 2007 (a fall of 11% in ten years). Among the farmers surveyed, 31 had seen a decline in their production, 12 had seen an increase, while yields had plateaued for two farmers. The use of hybrid seeds correlated with decreasing yields: 42% of farms that experienced decreasing yields were "hybrid" farms, while they represented only 36% of the total sample. In contrast, 75% of farms with increasing yields were mixed farms, that used hybrid seeds in combination with native seeds.

Similarly, organic production (no inputs of synthetic chemicals) is strongly associated with higher yields (about double). In the sample, farmers that used at least one artificial input in production obtained yields of about 317 kg/ha, compared to 644 kg/ha for organic farmers. The reasons for this difference could be due to the fact that organic farms were on average seven times smaller than others, and therefore allowed a greater intensity of labour, while also benefiting from more technical advice (more support given to the plantation). However, the possibility of greater resilience against typical yield decline linked to ageing plantations cannot be ruled out. This resilience could be related to the better conservation of soil nutrients, but also to the provision of ecosystem services such as natural pest control or the presence of pollinators (Jacobi *et al.*, 2015; Toledo-Hernandez *et al.*, 2017).

The deforestation that preceded the establishment of cocoa farms was mainly achieved through slash and burn techniques. Of the farmers surveyed, only one had practiced a thinning method (progressive replacement of native trees by trees with higher economic value), all others had carried out slash and burn.

There was a wide range of farm sizes, with the average of those sampled being 6.8 ha, but with much variation. Whereas organic farms were considerably smaller on average (1 ha compared to 7.2 for conventional farms). In general, the largest farms sampled were those with the lowest yields. This is linked to the fact that cocoa farms are largely family-owned and have little recourse to external labour and, consequently, larger plantations mean lower labour intensity on average, which impacts on yield.

The majority of farmers surveyed (61%) indicated a preference for a mixed system of hybrid and native seeds. In their view this mix allowed them to have both a better short-term income, due to the hybrid cocoa (more productive but more fragile), as well as a more constant income derived from native, more resilient, production. Moreover, this practice is relatively stable over time, according to 55% of farmers interviewed, i.e. there was no transition towards the uniform adoption of hybrid varieties.

Most farmers introduce a few shade trees to the cocoa tree fields, often native ones, but the diversity and quantity of these trees remains low. In Ghana, COCOBOD's official recommendation is to keep between 6 and 8 trees per acre, i.e. about 12 to 16 trees per hectare. And this is confirmed by all COCOBOD farmers and advisers. Farmers seem to adhere to this recommendation. Most explain that this provides a good balance, maintaining a lightly shading canopy above the cocoa plantation, while limiting the competition for water between shade trees and cocoa trees. Out of the surveyed farmers, 55% had the COCOBOD-recommended number of shade trees; 27% had less than 6 trees per acre and 18% have more than 8 trees per acre. Organic farms had an average of one more tree per hectare than others.

The majority of producers used chemical inputs, which is the legacy of an era of free distribution. For the farmers surveyed, the introduction of chemical inputs is a recent trend. Interviewed farmers and COCOBOD advisers said that this phenomenon developed from the mid-2000s. COCOBOD distributed free chemical inputs until 2015, and provided training to farmers on the application of these products. Following a change of government, the distribution of chemical inputs was no longer free or systematic. In some cases, farmers mentioned the availability of subsidies to make inputs more accessible.

6 Abbreviation of the Ghana Cocoa Board, the public regulator of Ghana's cocoa sector.

Many farmers point to the problem of dependency on chemical inputs. "*For years they have trained us to use these products, but now they are sold for a profit, so we can no longer afford them, so it's inevitable that my performance falls*!", said a Sefwi-Wiawso farmer. The use of chemical inputs is very widespread among conventional farmers, but is no longer systematic due to the irregularity of farmer incomes and, consequently, their ability to invest in these products.

In the group of farmers surveyed, almost all use at least one chemical input. 40% use herbicides, 29% use fungicides, and 20% use fertilizer; most use at least two of these three categories. Only farmers in organic cooperatives said they did not use chemical inputs.

The technical choices made mainly seemed to address the need for a fast income linked to a cash crop. It is from this particular angle that cocoa, particularly cocoa derived from hybrid plants, is seen as an opportunity, with the government giving confidence to farmers through price support. Six farmers cited a phrase that symbolises their state of mind on the subject: "*Hybrid seeds become productive so quickly that even old ladies plant them.*" Most trust COCOBOD to continue to improve hybrid seeds to increase their yields. However, 12% of farmers surveyed mentioned that increasing the amount of shade trees could be an opportunity for the future. They explained that cocoa trees are better at resisting drought and high temperature episodes when surrounded by shade trees.

Paradoxically, however, one of the most commonly identified threats according to producers was the fragility of hybrid cocoa. Of the sampled farmers, 22% said that the spread of pests was the main future threat. They considered that despite extensive pesticide use, episodes of infestation were becoming more common, which they linked to the fact that it is not possible to use pesticides often enough due to costs. 18% of farmers surveyed cited climate change as a future threat to their production. They explained that climate change could destroy their production, through increasingly frequent periods of drought. 18% cited the lifespan of hybrid cocoa trees as a threat to their production. In their experience, although hybrid cocoa produce fruit from as early as the third year after planting, they also die very early, between the tenth and fifteenth year. Native cocoa trees can live for up to 30 years. 12% cited hybrid cocoa tree yields as a risk, which may seem contradictory given the 24% who cited hybrid cocoa yields as an opportunity. This paradox is explained by the fact that farmers who regarded climate change and hybrid yields as a threat, were also the ones that had suffered most from droughts and heat spikes. They described how the first trees to die during periods of drought are hybrids, while those that survive produce proportionately less cocoa than hybrid trees.

It was not within the survey's scope to make measurements of the biodiversity levels associated with the observed situations. However, the farmers themselves were questioned about their observations of declining biodiversity on their plots and their surroundings, and the answers obtained were complete and precise. The impression was almost unanimous: only one farmer surveyed noticed no loss of biodiversity on his plantation. Mammals were the main species category mentioned as declining (39%), particularly monkeys and game (wild boar, agouti...). Moreover, the scarcity of game animals has significantly increased dependence on local markets. 20% of farmers had noticed a decrease in the presence of birds on their farms, mainly parrots and vultures. Flora and insects were cited by 13% of farmers. With regard to flora, farmers noted the disappearance of mosses and fungi. For insects, ants and termites were the most cited. 11% of farmers cited the disappearance of invertebrates, such as giant African snails and slugs.

In the surveyed area, plots were cleared on average about 25 years ago (23.7 years to be exact), with little variation around this average (with the exception of two observations). There is some correlation between the perception of the loss of flora and the relative time since deforestation, and an inverse relationship between the perception of the decline of mammals and the time since deforestation. The perception of biodiversity loss did not correlate with the difference in shade level (within the range of tree quantity per hectare, which is reduced); on the other hand, this perception is accentuated in relation to the amount of pesticide use: farmers using chemical inputs noticed a loss of biodiversity four times greater than those who did not. This result should be put into perspective because farmers using chemical inputs are overrepresented in the sample.

There is also a significant correlation between the use of chemical inputs and the perceived decline in yields. Although it is not possible to say with any certainty whether low yields are the reason why producers use inputs, or whether the use of inputs could partly explain falling yields, for example through their impact on cocoa pollinators.

Our study finds that the question of the link between cocoa cultivation types and biodiversity has not yet been the subject of much research. When addressing this question, the available literature mainly focuses on the number of trees—other than cocoa trees—per hectare, either associated with plantations (most often in West Africa) or with a harvest and replacement of the forest (most often in Latin America). The most common differentiation of cocoa farms from this perspective is that proposed by François Ruf, who identified five types ranging from plantations with sparse tree cover to those with abundant cover and several strata, known as "complex".

Available results suggest that a relatively high level of biodiversity can be retained when a significant number of forest trees are conserved. In such so-called complex agroforestry systems, some of the characteristics of the natural forest ecosystem can be observed, although of course this cannot match the richness and abundance of the original.

It should be noted that the literature does not present analyses of the links between types of cocoa production and biodiversity from a pollution perspective, potentially that generated by the use of chemical inputs.

Our own analysis carried out on a sample of about 30 farmers in three regions of Ghana provided the following conclusions: in Ghana, the predominant form of "agroforestry" seems to be simple agroforestry with a limited number of trees per hectare, a practice that the literature does not associate with a good

level of biodiversity conservation; observed yields are low and tend to decline, especially in farms using "hybrid" seeds, which are designed for improved productivity, but which are fragile and have a limited lifespan. In contrast, the few organic farms that were surveyed showed double the average yields, probably due to their high labour intensity; based on what the farmers declared, the observed biodiversity is reduced and is decreasing, primarily in terms of the presence of mammals, regardless of the number of shade trees present, within the limited range of shading practiced by the farmers in the sample; this observation is lower in farms that do not use chemical inputs.

Ghanaian cocoa production as it is, does not enable satisfactory biodiversity conservation because the main practice employed here is simple agroforestry. The specific impacts of chemical inputs have yet to be studied.

Cocoa cultivation is therefore largely associated with deforestation in the tropics. Also, the farming methods used result in a considerable reduction in biodiversity compared to the surrounding natural ecosystems, apart from when complex agroforestry systems are implemented, but these systems are almost absent in the main producing countries. Given that all global biodiversity indicators are raising the alarm, there is an urgent need to develop cocoa farming methods that are more compatible with the conservation and, where appropriate, the restoration of ecosystems. While existing laws and regulations have not enabled a limitation of the impacts of cocoa cultivation, many private initiatives have emerged to ensure that cocoa and chocolate production processes respect social norms (income level, no child labour) and the environment (no deforestation, reduction of chemical pollution). The following section aims to review the main initiatives of this type and evaluate their performance.

2. INITIATIVES FOR SUSTAINABILITY

The impacts of cocoa cultivation on biodiversity, which was discussed in the first part of this study, have been the subject of increasing awareness in recent years from the various actors in the value chain. This has been reflected in the commitments made by industry recently, but also by the main producing countries (Ivory Coast and Ghana, Ecofin, 2019) and by some major consumer countries such as Germany and Switzerland, which have created public-private platforms to promote sustainability in the chocolate industry.[7]

To respond to these challenges, and also to the growing consumer demand for sustainability, industry actors have implemented various initiatives designed to ensure sustainable cocoa production in the global market. This part of our study aims to analyse and compare the main initiatives to better understand what levers they seek to use, and what are their possible markers of success.

To examine the various sustainability initiatives of the cocoa sector, we studied their "theories of change" and compared them to their results and impacts, as reported in the literature. We follow the approach developed by IDDRI for palm oil (Aubert *et al.*, 2017). The theory of change concept is borrowed from Weiss (1997) and is defined as "*the assumptions made about the actions that should be taken either to counter/reverse processes which are considered as impacting upon the sustainability of the sector; or to foster other processes that are deemed to enhance this sustainability*." Therefore the purpose of this part of the study is to compare the theory of change of each initiative considered with results published in the literature regarding their actual implementation.

2.1. Fairtrade and organic farming: certification pioneers

Although not specific to the cocoa sector, "organic" and fair trade standards are particularly well developed in this field. They have enabled the development of specific sectors based on a guarantee of sustainability, in social terms for fair trade and ecologically for organic, based on the main principles of these two certification standards that were developed in the 1990s, but whose origins date back to the 1970s.

2.1.1. The fair trade approach, a focus on a fair price

Fair trade originates from multiple initiatives undertaken during the twentieth century to create marketing channels to help disadvantaged populations by allowing them to sell their craft or agricultural produce directly to European and North American consumers. In 1964, the United Nations Conference on Trade and Development (UNCTAD) established the slogan "Trade not Aid" which aimed to move away from the traditional rationale of providing assistance.[8] The idea was to develop, in addition to direct links between producers and consumers, a fair price to cover production costs and ensure that producers could afford a decent standard of living.

The start of labelling and internal debate

The 1980s marked a turning point, with the creation in the Netherlands of the first label: Max Havelaar, in 1988. The creation of labels addressed the need to expand the fair trade distribution network. Indeed, despite the growing number of "worldshops", some of the sector's actors believed that the direct distribution network from producer to consumer had reached its limit. To allow fair trade to reach supermarket shelves and traditional retailers, a guarantee of compliance with fair trade rules had to be implemented, that would no longer be controlled by the

7 See: de Preux (2018) ; https://www.kakaoforum.de

8 Artisan du monde, website, https://www.artisansdumonde.org

sector itself, but by a "third party" certification body that could ensure that all actors, producers, intermediaries and distributors adhered to the specifications. Thus, it became possible for "labelled" products to be distributed through conventional trade routes, including via large central purchasing companies (Daviron & Vagneron, 2011). The role of fair trade advocates also changed at this point: they were no longer buying and reselling products, but were now positioned "outside" of the value chain, becoming the guarantors of compliance with the defined standards.

Fair trade continued to develop, although not without debate between the different actors involved, not all of whom agreed with the move towards labelling (Bucolo, 2003). Meanwhile the number of labels and procedures further increased. To ensure consistency in the approach and the adopted standards, fair trade actors joined forces in umbrella organisations, although some had divergent visions. These included, for example: IFAT (International Fair Trade Association) that was formed in 1989 and became the WFTO (World Fair Trade Organisation) in 2008; EFTA (European Fair Trade Association) established in 1990, which gathers together importers of fair trade products; NEWS (Network of European Worldshops) established in 1994 by the Worldshops movement, which joined the WFTO in 2008; and FLO (Fairtrade Labelling Organisations), which was formed in 1997 as a product of the impetus generated by Max Havelaar, which became Fairtrade International in 2011.

In 2001, these four organisations created a working group that led to the "FINE consensus", which proposed a common definition of fair trade. The adopted definition was as follows: "*Fair Trade is a trading partnership based on dialogue, transparency and respect, which seeks greater equity in international trade. It contributes to sustainable development by offering better trading conditions to marginalised producers and workers – especially in the South, and securing their rights. To achieve these objectives it implements better terms of business, aims to raise public awareness on the issue and conducts campaigns.*"[9]

Fairtrade International and WFTO are today the two leading global networks of fair trade organisations. In 2009, the two organisations agreed on an international fair trade charter (revised in 2018). Using this document it is possible to describe the theory of change (TOC) for fair trade.

Fair trade theory of change

Overall, the fair trade TOC is based on the notion of "re-embedding" (Doussin 2009, Ferraton and Prevost 2013). It involves stepping back from market autonomy from society, which characterizes the development of the liberal and neo-liberal economy, to go towards a re-embedding of "social" values into commerce, and vice versa.

From this shared objective, the fair trade movement has two contrasting visions:

- the first is that change will come through the creation of an alternative market that is "external" to the usual commercial channels. This theory stems from the worldshops movement which emphasises direct connection between producers and consumers through ad hoc channels;
- the second vision is a labelling approach, aiming for fair trade products to infiltrate traditional commercial channels, based on the idea that the best way to achieve fair trade objectives is to reach the largest possible number of consumers, by making products available in conventional commercial outlets. This vision "considers that we can use the mechanisms [of traditional trade] to increase progressively, due to the demands of consumers who are increasingly informed and aware of the power of their purchasing decisions, the share of labelled products and thus modify the practices of international trade" (Doussin, 2009, p.30). It is not therefore a question of creating a parallel alternative market, but of changing the traditional market "from the inside".

Although these two approaches are very different and will therefore encourage different practices, we can nevertheless design a common TOC for fair trade[10] from the available literature, that should be based, in our opinion, on four intermediate outcomes.

1. Find value chain actors that are willing to pay "extra" to access fair trade products.

2. Strengthen, through producer organisations, production capacity, market access and social well-being.

3. Strengthen the direct links between producers and consumers to rebalance bargaining power and to make buyers aware of a fair trade approach (it is mainly on this point that the "labelling" and "parallel market" visions of fair trade diverge).

4. Change the rules of international trade through joint action by consumers and producers with international regulatory authorities.

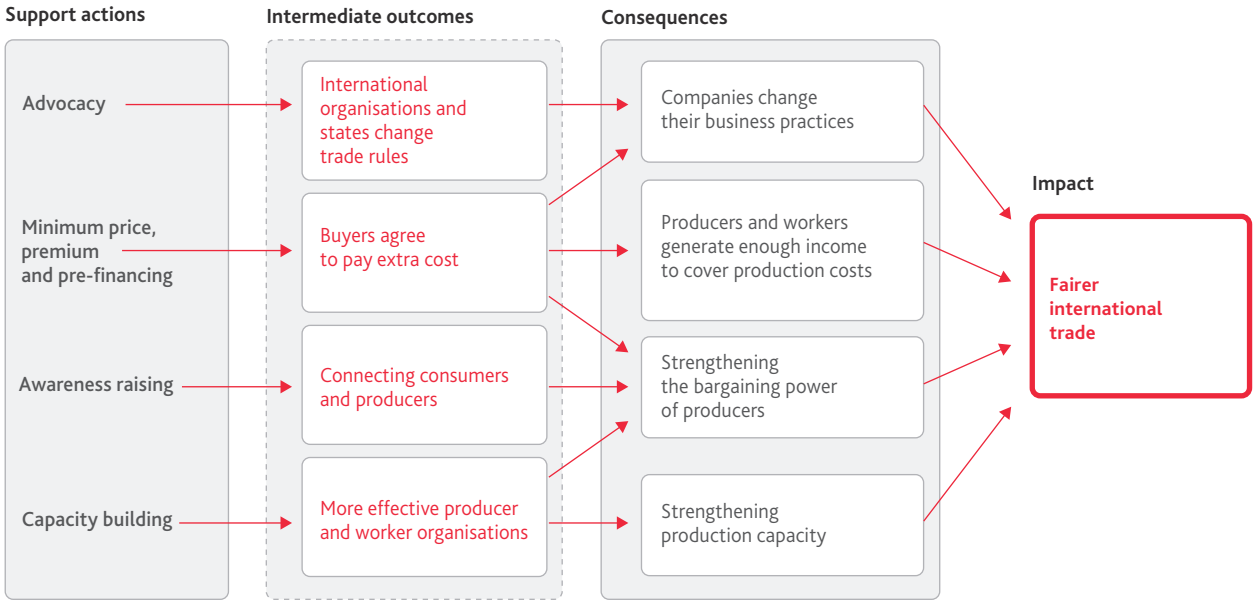
These four objectives are highly dependent on each other and form the basis of an impact loop that is illustrated in **Figure 7**. The environmental issue, particularly biodiversity conservation, does not appear in the theory of change. When the relevant literature touches on the issue it is generally regarded as a positive consequence of the improvement of the living conditions of producers and workers. The underlying ideas behind fair trade do not explain why or how agricultural practices would evolve towards better biodiversity protection. At least not directly.

The environmental component is developed mainly through incentives (or even injunctions) for the modification of the

9 Adéquations, 2009.

10 This theory of change is very clearly defined in a Fairtrade International paper entitled Journeys to Change, Fairtrade Theory of Change (Fairtrade, 2015). The four above-mentioned hypotheses, although in a slightly different formulation, are: 1. To change consumer behaviour by raising awareness; 2. To strengthen small producer and worker organisations; 3. To change practices in the supply chain (it is no longer a question of a direct link, but of "changing practices", without being precise); 4. To strengthen the influence of civil society on trade policies and practices. We have opted to use our own reformulations to better reflect the range of visions within fair trade.

FIGURE 7. Fair trade theory of change



Source: Authors, based on the Fair Trade Charter (2018); Doussin (2009); Ferraton and Prevost (2013); Fairtrade International (2015).

practices carried out by the producers. So-called "sustainable" practices are even "made compulsory" (Doussin, 2009, p.39). The theoretical link between a better economic situation and a greater respect for the environment is not theorised, except through the notion of "sustainable production costs", which is a development of fair trade objectives. It is generally recognised that for fair trade to have an impact on the environment, the remuneration of producers and workers must "cover the cost of sustainable production" (Doussin, 2009, p.35) i.e. that "the entire value chain should be managed in such a way as to ensure that the actual cost of good environmental practice is reflected in the prices and terms of trade" (International Fair Trade Charter, 2018). One of the practices implemented to achieve this objective is the payment of an "additional premium" for organic products, in addition to the fair trade premium (see below). It must therefore be concluded, for our purposes here, that the intended impact of the fair trade theory of change on the environment and biodiversity depends directly on the realisation of the first four hypotheses, which must lead to a guarantee for producers and workers on an adequate and sustainable income, and a requirement for additional and specific criteria to be added to the initial socio-economic criteria. We can draw several conclusions by comparing this theory of change and its assumptions with the real life situation:

The first intermediate outcome assumes that the buyers, i.e. the intermediaries, but also ultimately the final consumers, are ready to pay a premium to finance a fairer trade. This premium is justified by additional constraints in terms of transparency and quality that impact on the sector, but also by the specificity of fair trade, which is to guarantee a minimum price to the producer as well as a fair trade "premium". A minimum price is intended to enable producers to cover their "costs of sustainable production". It is set by each fair trade organisation according to different criteria, and as part of an exchange with producers and workers and companies in the supply chain. Each revision of the guaranteed minimum price is subject to several months of consultation and workshops.

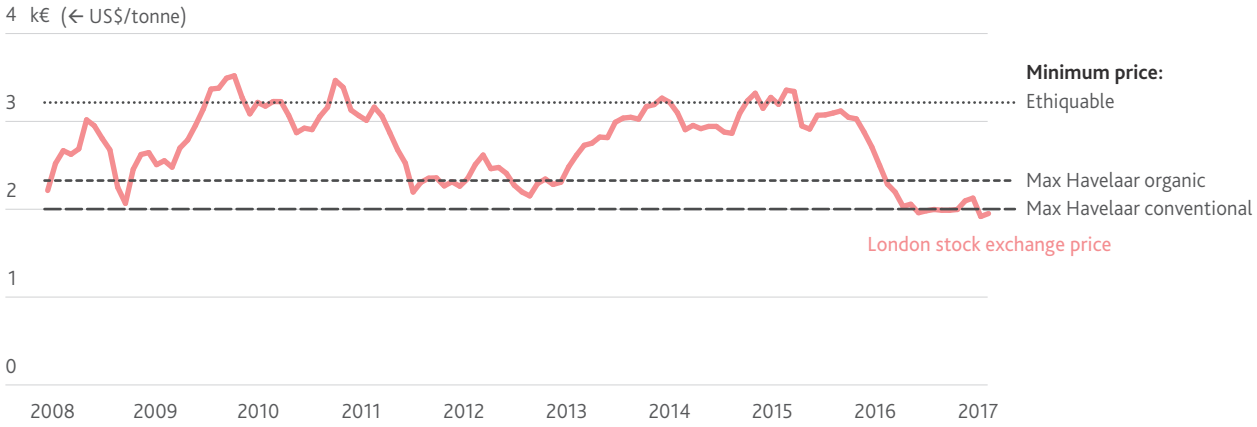
It is thus clear that this minimum price is not determined by a detailed assessment of the producer's needs or the above mentioned costs of sustainable production, but through a negotiation process in the classic sense—between actors on the supply and demand sides. This situation raises questions regarding the capability of this price to meet the required objectives. Indeed, in these circumstances, the minimum price must be sufficiently higher than the average market price to encourage producers to enter into the certification process or into a contractual relationship with an importer in the fair trade sphere, but not too far above the market price to avoid discouraging potential buyers who may worry about their margins being squeezed or a potential lack of demand for the final product due to excessively high prices. For these reasons, the minimum fair trade price remains fundamentally "anchored" to the market price (Ferraton and Prévost, 2013). This is the way it is expressed by the actors: "the market price + x".[11]

As summed up by a Max Havelaar France senior executive at an exchange workshop on the cocoa purchase price: "We know we've struck the right balance when nobody is happy".[12]

11 Given that the "market price" is generally understood to mean the price on the London Stock Exchange.

12 Workshop on the cocoa price organised by Max Havelaar France in Montreuil, 16 July 2018

FIGURE 8. World cocoa price and guaranteed minimum prices of fair trade organisations between 2008 and 2018



Source: ICCO, Max Havelaar website*, Ethiquable website**.

** Max Havelaar: https://www.maxhavelaarfrance.org/les-produits-fairtrade-maxhavelaar/cacao-chocolat-equitable/ accessed on 6 June 2019. Note that these prices were revised upwards from October 2019.** Ethiquable : http://www.ethiquable.coop/page-dactualites-mag/pourquoi-vous-ne-verrez-pas-nouveau-label-max-havelaar-sur-nos-produits.*

That is, when the producer feels that the price is still not high enough, but the buyer is starting to find it too expensive.

One of the consequences of this situation is that, contrary to the fair trade theoretical literature, the guaranteed minimum price is not always higher than the market price. For example, in the cocoa market, where major countries such as Ghana and Ivory Coast have set guaranteed minimum prices for producers, the fair trade minimum price remains below the national price. In this case, the price incentive has little impact on producers. However, they may be attracted by the prospect of new, more reliable markets, or by offers of help and support, or because they are concerned about falling prices and are seeking ways of protecting their own interests.

As shown in **Figure 8**, during the last ten years Max Havelaar's guaranteed minimum price of $2,000 per tonne has almost never been "activated", except in 2017 when prices collapsed. This means that in terms of prices, producers have not seen any difference between fair trade and world prices, or at least only a marginal one. The minimum price for organic cocoa, $2,300 per tonne, has been activated more often, but still very episodically. In comparison, the minimum price set by Éthiquable, a French fair trade company, of $3,200 per tonne, was activated throughout almost the entire period.

However, it should be noted that a fixed "premium" is added to this price, which therefore is added to the price paid at the global rate, even when the minimum price has not been "activated". There is therefore a price difference between conventional trade and fair trade for labelling organisations. However, this premium is usually reserved for the operation of producer and worker organisations, and must be used to enable collective projects to be implemented (training, equipment, schools, health...). Moreover, this bonus remains relatively low, around $200 per tonne, which is less than 10% of the average price. In comparison, in a report published by a coalition of NGOs, Cocoa Barometer estimated that the average cocoa farmer's income in Ivory Coast is $0.5 per day, when the World Bank defines the poverty line as $2 a day. To escape from poverty would therefore require a 400% increase in producer income (Cocoa barometer, 2015)!

The second consequence is that large companies that have started to get involved in the fair trade movement are starting to develop mistrust and a disengagement from the labels, as was the case for Cadbury's in 2016.[13] Indeed, multinational companies that have agreed to increase their purchase prices (mainly because of the premium) may withdraw if the benefits are not sufficiently obvious, especially if the approach does not exclude them from reputational risk, which is often the driving force behind their engagement decisions. For example, Mondelez in the Dominican Republic is beginning to question whether it should continue its fair trade commitments: "The Fairtrade premium did not go directly to farmers. It was directed towards the head of the co-operative, and mysteriously the head's children suddenly had apartments in Boston (...). If investigative journalists decided to find out what's going on, it could have a very big impact. So they (Mondelez) decided to get out of it, to take that money, and to invest it over five years" (Director of Development of a Dominican Cocoa Export Company).[14]

It is not only multinational companies that remain to be convinced. A well known French chocolatier/confectioner that produces fine artisanal chocolates in the sustainable sector, noted that "everyone pays": the producer, the intermediaries, the final buyer, everyone has to assume an additional cost related to the price of the goods or the certification process.[15] At the same time, "conventional" channels continue to operate on market rates. Thus, in a competitive market, actors in sustainable sectors are disadvantaged by additional costs related to

13 Radionova, 2016

14 Personal communication, February 2018.

15 Patrick Roger, Personal Communication, February 2018

their practices, compared to conventional actors. This raises questions especially about the likelihood that a more virtuous, but more expensive, trade could impose itself, in the context of a competitive market, when in competition with a trade that was less fair, but cheaper in the short term for the end consumer and intermediaries.

The second intermediate outcome expected from fair trade is the strengthening of producer and worker organisations. Local organisations are seen as the most likely to spread good practices, to organize the pooling of resources for the benefit of the community, and to strengthen the negotiation capacity of producers in relation to other actors. In the field, this expectation has proved itself, at least in the case of certain producer organisations, and these successes have fuelled the success stories of fair trade organisations, through the highlighting of cooperatives and producer associations that have been able to transform the daily lives of their members.[16] The capacity building of these organisations is sometimes even considered as a means of offsetting the low impact of increased producer incomes in the context of fair trade evaluations (Poncelet *et al.*, 2005).

However, several studies have shown that supporting and strengthening producer and worker organisations is not always sufficient to trigger a fair trade "virtuous circle". In many cases, it has even been noted that one of the conditions for a fair trade to have a positive impact on the population is the pre-existence of strong and structured producer organisations, on which the fair trade approach can be based (BASIC, 2016; Bécheur & Toulouse, 2008, p.153). What seems more complicated is providing support to highly marginalised populations, where collective organisations are still lacking (Poncelet *et al.*, 2005).

Agricultural workers represent an even more particular case. In industrial plantations it is the worker organisations that have to play the usual role of cooperatives and producer organisations. In addition, several changes to the fair trade model are needed. To guarantee a certain standard of living and a decent income, fair trade is based on national regulations in terms of labour laws (wages, working conditions, social security cover, etc.) or on international law when it is more protective (mainly the ILO Conventions). The payment of a development premium is no longer carried out through producer associations or management cooperatives, but through a "joint management body" that includes workers, worker representatives and employers. This organisation is responsible for ensuring that the development bonus is used for the benefit of the group (Doussin, 2009, p.67).

But these arrangements are not without problems. The first of which is that management bodies remain heavily dependent on the means and leeway that employers allow them, and secondly because it is the company, and therefore the employer, that commits to the certification process, it inevitably becomes the interlocutor between certification bodies and fair trade organisations. The labelling of plantations therefore gives a key role to industrial companies in the relationship between the engaged consumer and the worker. The success of the process therefore depends on whether or not the company's commitments are respected, and that the pressure and bargaining power is often much higher than that of the workers.

This situation causes friction with workers' unions. By introducing a new form of employee representation in companies through the Joint Management Committee, fair trade can maintain a certain amount of confusion which not only impinges on trade union prerogatives, but can deter the formation of unions in plantations where they are not yet present. However, the role of these management committees is strictly limited to the management of the development premium, and their action to enforce fair trade standards, such as labour laws, remains limited (Doussin, 2009 p.113). In their book *L'aventure du commerce équitable* (Roozen & Hoff, 2002), Nico Roozen and Frans van der Hoff, the co-founders of Max Havelaar, justify the choice of Max Havelaar by the virtual absence of autonomous trade unions (the main unions being controlled by employers) in multinational banana plantations. Moreover, according to the authors, the "Marxist trade union rhetoric" of the remaining autonomous unions have contributed to their marginalisation and the fact that workers had lost confidence in them. "Although the right to form an organisation remains a basic principle of fair trade, it will be difficult to achieve this in the near future," they noted.

The third situation is that of independent producers employing seasonal workers or agricultural labourers. In these situations there are no unions or mixed management organisations. These common situations seem to be a blind spot in the process, and it seems difficult to guarantee the respect of ethics concerning the salaries of these employees. Beyond that, it also raises the question of family labour: children, wives, or spouses. Although fair trade principles are clear in this respect, the informal nature of family support in many situations makes it difficult to take this into account. Especially since the minimum respect of national or international standards is far from sufficient to guarantee dignified living conditions or a satisfactory income. In certified banana plantations, for example, workers continue to survive under extremely difficult conditions, even though the company fulfils all the requirements of the specifications, including compliance with national labour laws (Dumeurger, 2017).

The third intermediate outcome expected from fair trade is a contentious issue that divides opinions within fair trade. Two main strategies are emerging: the creation of dedicated channels, and labelling within conventional channels. These two different approaches are supposed to address the observation that had been formulated regarding the stalemate of traditional trade, according to which "markets are generally dominated by a handful of international companies with the power to set the trade rules for their suppliers by imposing low prices, which are often below the total costs of production" (International Fair Trade Charter, 2018).

Thus, the answer to this imbalance is through the creation of new channels for producers, by privileging the non-exclusivity

16 See for example "Les bananes Oké" in Roozen & van der Hoff (2002, p. 149); or the various activity reports of fair trade organisations.

of commercial partnerships (Doussin, 2009). Clearly, this would free farmers from the influence of a few multinationals, allowing them to sell their production elsewhere, and at a better price. To create these markets, fair trade relies on the awareness of consumers who must create a "demand" for more transparent and better remunerated sectors.

Consumer awareness of fair trade issues is an undeniable success. The number of consumers familiar with fair trade rose from 9% in 2001 to 81% in 2007 (Doussin, 2009). Yet, while 88% of French people consider fair trade a positive step, only 28% are regular buyers.[17] In addition, only 3% of global cocoa production is certified fair trade, even though cocoa is a flagship of the movement. It therefore seems, at least at present, that consumer awareness has only marginally translated into purchasing (see hypothesis 1 analysis).

Fair trade, whether sector-based or involving labelling, remains marginal, and given these conditions it is difficult to develop real alternative markets for producers. In the context of cocoa, it is also striking that only 33% of the certified production available is sold under fair trade conditions. In other words, producers who commit to adhere to production standards only derive the guaranteed minimum price and development premium from one third of their harvest (on average). The remaining two thirds is sold on the conventional market at the going rate, and more importantly, without a premium.

This situation not only weakens further the incomes of producers who only benefit from the price guarantee on a proportion of their crop, but it is also a symptom of the structural overproduction of fair trade cocoa in relation to demand. This overproduction has consequences on the bargaining power of producers. Encouraged by the development of labelling, this overproduction crisis has led to the emergence of competition within labelled markets, described by Daviron and Vagneron (2011). This competition would have no impact on purchase prices if the guaranteed minimum was always higher than the fluctuating global price, but as previously discussed, this minimum price has only very rarely been activated in recent years.

Ultimately, the huge increase in the supply of fair trade produce, accompanied by the significant rise, although to a much lesser extent, in demand, has led to an imbalance which, in line with classical economics, gives increasing power to the downstream part of the sector. In particular, producers are required to sell a significant part of their produce on the conventional market, for which they do not find fair trade buyers.

Therefore, it seems that there remains much work to be done to achieve a rebalancing of bargaining power, and it is even necessary to question the relevance of the underlying analysis, which assumes that the cause of the dependence of producers on buyers stems from the exclusive nature of the business relationship. In fact, the reintroduction of competition in the fair trade market has resulted in an exacerbation of the power imbalances within the supply chain. It should not be forgotten that the theory of fair trade is also based on the possibility of forming "long-term" partnerships, which implies the creation of reciprocal obligations between buyers and producers: such as a purchase guarantee that would allow producers to be assured of selling all their production under fair trade conditions.

The fourth intermediate outcome is more difficult to evaluate, at least as far as the efficiency of fair trade actors is concerned. Indeed, changes to business practices or international regulations may be the result of many factors. We will therefore verify, without prejudging the causes, whether this hypothesis is being realised or not.

In recent years there have been several advances in the regulation of international trade and economic activities. Among these was the creation of the Global Compact in 2000, in which companies committed to evolving towards socially responsible practices; the adoption of the FAO's Voluntary Guidelines for Responsible Governance of Tenure Systems in 2012; and, in France, the 27 March 2017 law on the duty of vigilance of parent companies and contractors. But these significant advances should not obscure the fact that, in general, improving the regulation of international trade is at odds with developments in recent decades. Indeed, at the time when fair trade federations were forming in the 1990s, the cocoa and coffee markets were massively liberalised and deregulated, which put an end to multilateral attempts to regulate the market by controlling stocks and prices (Lipchitz, A. & Pouch, T., 2008). This rationale has never been denied.

As such, it is interesting to note that the above-mentioned advances are initiatives that do not set clear rules for companies to follow. The Global Compact and the FAO Voluntary Guidelines are sets of principles that companies are free to adopt voluntarily. While the French law indeed creates an obligation for companies in terms of preventing damage to the environment and human rights, this is not an obligation of results. However, it should be noted that, within the spirit of these voluntary commitments, the development of sustainable labelling, albeit marginal, has created a real momentum by encouraging the creation of many other "sustainable" labels, first and foremost of which for the cocoa sector is the Rainforest Alliance and UTZ labels, which we study further below (Doussin, 2009, p.76). A more recent development, to meet consumer demand for more sustainable products, is that companies have introduced their own "voluntary" internal commitments, responding to the need to differentiate their brands on the market.

Fair trade has thus played a major role as a pioneer and a champion, spreading the idea that brands must guarantee the quality and sustainability of their products. An approach reinforced by the emergence of directives and regulations with varying degrees of restrictiveness, that push large companies to adopt such policies. In this trend we are witnessing at least a partial realisation of the schematic impact loop, shown in **Figure 7**, that pushes companies to change their practices under pressure from international organisations and consumers whose awareness has been raised by fair trade and other approaches, such as organic farming.

17 Max Havelaar France website, accessed on 2 October 2018.

However, the effectiveness of these changes in practices in terms of their ability to improve the living conditions of producers remains questionable, given the current figures on producer incomes, which remain extremely low, and whose share in the value of finished products steadily decreases (BASIC, 2016). The effectiveness of the voluntary commitments of companies will therefore be decisive in assessing the truly transformative nature of the fourth hypothesis in future, particularly in the absence of truly binding regulations in this sector.

In conclusion, it is clear that the fair trade theory of change is struggling to materialize due to difficulties in achieving the primary goal of fair trade, which is to improve the incomes of producers and workers. It seems that fair trade has not succeeded in substantially improving the incomes of the producers in its network, nor in integrating the most fragile and least organised populations into this network. But whether fair trade can have a positive impact on biodiversity protection depends on whether it has the capacity to cover the costs of sustainable production. This situation is linked to the fact that the purchase price for consumers still depends strongly on the global market due to difficulties involved in developing an alternative economic model for these producers based on the diversification of markets. This difficulty is mainly due to the extra cost that the establishment of a truly lucrative exchange system would represent for all actors in the chain. Although consumers are now highly aware of these issues, this additional cost represents a major obstacle to the transformation of purchasing practices for mid-chain actors. The absence of binding regulations in the sector and thus the opportunity created for less virtuous actors to offer low-cost produce in a context of structural overproduction means that there is little prospect for a positive evolution of this situation, and the transformation of the current economic model of the global market therefore today essentially relies on the voluntary commitments of companies, the impacts of which remain to be determined.

2.1.2. Organic farming

The organic farming movement began in the late nineteenth century, initially as a rather conservative form of resistance to the increasing mechanisation of agriculture and the use of mineral fertilizers. The movement brings together supporters of a more traditional form of agriculture, based on polyculture-livestock systems and respect for natural cycles, including soils, with advocates for better food quality, including a number of doctors and pharmacists (Sylvander, François, & Morin, 2005; Leroux, 2015; Poméon, Fouilleux, & Lemeilleur, 2017; de Silguy, 1991).

The first theoreticians of an "alternative" form of agriculture that follows guiding principles emerged in the twentieth century: Albert Howard, Hans Peter Rusch and Rudolf Steiner. The latter, who founded the esoteric anthroposophy movement, inspired the first "label" for organic farming (which he called biodynamic), Demeter, which appeared in Germany in 1928.

Other sections of the movement did not structure themselves until the second half of the 20th century, particularly in response to upheavals in European and North American agriculture in the 1960s (rural exodus, consolidation, farmer debt, extensive mechanisation, etc.). At that time, two major trends emerged: one more market-oriented, which considers organic farming as a set of traditional techniques to be preserved (embodied by the "Lemaire and Boucher" movement in France) (Sylvander, François , & Morin, 2005); and the other which positions organic agriculture as more of a global protest movement against consumer society and which considers that the reform of commercialisation must go hand in hand with the transformation of agricultural techniques (embodied in France, for example, by the Nature & Progrès Association, created in 1964).

At the end of the 1980s, organic farming adopted a new direction in terms of structuring and ensuring consistency of the various approaches. In Europe this took the form of a common certification system, that the European Commission guaranteed from 1991 onwards. From then on, due to the influence of the European market, the European label became an international reference from which the various approaches are defined (Poméon *et al.*, 2017, p.189). This "normalisation" was not without resistance or competition from other approaches, which had varying degrees of compatibility with the European standard (known as "Eurofeuille" (Euro-leaf) due to its leaf-shaped logo), such as other certification systems, refusal of certification, etc. Discussions within the International Federation of Organic Agriculture Movement (IFOAM) took place aiming to organize the debate and maintain international coherence among the different approaches, all claiming to be organic farming (Poméon *et al.*, 2017).

In recent decades, two strategies have been operating in the development of organic farming, in a similar way to the evolution of the fair trade movement: a strategy of rejection of the conventional market and the creation of parallel sectors based on the close proximity of producers, intermediaries and consumers; and an "entryism" strategy to infiltrate the market with labels that create economic niches within the market, but at the cost of the standardisation of production methods, based on an essentially technical interpretation of what constitutes organic farming, to the detriment of a more "political" and holistic vision that takes into account the whole approach taken by producers and consumers (Poméon *et al.*, 2017).

The different organic farming movements can be placed on a scale between these two extremes, and can be characterised by the range of motivations and approaches of their actors. However, these movements share the same rejection of the dominant agricultural model (so-called conventional agriculture) that Piriou (2002)[18] categorised according to three major areas of dispute:

18 Quoted by Poméon *et al.* (2017) p. 183

1. confirmation of the link between production modes, food and health;

2. producer autonomy in the supply chain (for input purchases and sale of produce);

3. preservation of natural ecosystems.

From an agronomic point of view, the approach of the European organic label is reflected in a set of principles aiming to bring agricultural models closer to the natural functioning of ecosystems: the rejection of synthetic inputs and fertilizers, more extensive cultivation, use of fallow land, composting methods, low till and crop rotation. These techniques are generally more costly in terms of labour and land than conventional farming techniques, and therefore generate higher production costs, which is partly offset by the low level of inputs. Similarly, the decline in productivity brought about by crop extensification automatically leads to an increase in the production costs of agricultural products.

From an economic perspective, we can therefore consider that this increase in production costs corresponds to an internalisation of the negative externalities linked to agricultural practices, in the form either of a reduction of impacts (decrease of inputs, ploughing, etc.), or compensation (composting practices, fallow land…). It is this integration of externalities that justifies the price differential of organic products. To remain competitive in a market where these rules are not imposed on everyone, it is therefore necessary for organic agriculture to differentiate itself from the general competition by creating a "niche" market.

This logic leads, on the one hand, to direct supply chains in a market for activists, and on the other hand, to organic labelling on the conventional market. The requirement to comply with relatively stringent conditions, accompanied by the requirement to undergo an expensive certification process create "barriers to the entry into the organic market that protect organic farmers from direct competition with the conventional market" (Guthmann, 2004).

It thus appears that organic has a relatively linear theory of change, which is not really formulated anywhere, except in academic analyses of the sector, where it appears in various forms, and from which it can be supposed that it was constituted empirically, as and when the needs of the development of these practices grew, practices that were initially oriented towards the search for a diet that is healthier and more respectful of nature.

The various elements of this TOC have therefore been implemented in a rather inverse way: by seeking to practice a more respectful form of agriculture, farmers have developed techniques that have reintegrated externalities; the resulting increase in production costs pushed up selling prices, encouraging producers to search for markets capable of meeting this additional cost. With the proliferation of organic offerings, the formalisation of specifications and labels have made it possible to guarantee the specificity of the offer and to create the conditions necessary to win the trust of consumers (Sylvander, 1997).

A complex mechanism of price formation

The first result of this theory of change is thus to create confidence in organic farming. This step is all the more important since the movement has largely been built in defiance of conventional agriculture and the quality of its products. This step is essential to justify the higher price for organic products, given that organic does not set a minimum price, to enable production costs to be covered. The cost of entry into the organic sector (in terms of changes in practices and certification) is indeed significant, and the sector's survival depends on its ability to cover these costs, or even to release an added value to encourage producers to invest in the process.

It is the compliance with demanding standards that justifies to the consumer the addition of an organic premium (Guthman, 2007). It is in fact what De Silguy (2017) called a "promise of difference", which would be lost if the offer is generalised. This difference partly justifies the price gap between conventional and organic. In short, in the way of classical economics, the less the scarcity of a product, the less it is valued. Similarly, an increase in the supply of organic produce may lead to a lowering of the price signal, and therefore of the additional income for producers, even though production costs will remain higher. The risk for the organic farmer is therefore no longer associated with finding buyers willing to pay a price that corresponds to the production costs. Especially because new industrial players are at the same time investing in the market, benefiting from significant economies of scale that enable them to offer a labelled product at a lower cost.

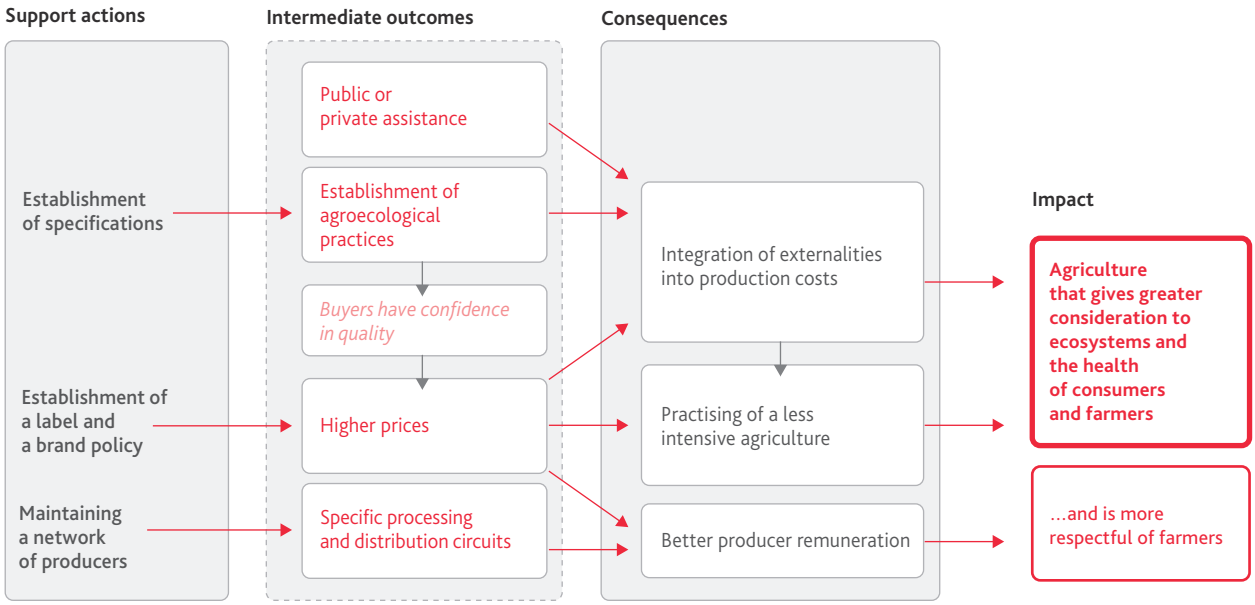
This decline in the price signal is evident among the Dominican producers we surveyed. An exporter told us: "*We have created value with a wave of certification, but it comes and goes. But when everyone has the same certificate… Hegel said, if everybody had all the rights, no one would have any rights*." In other words: the day everyone sells organic cocoa, nobody will get any additional economic benefits from it.

According to an expert from the United Nations Development Program (UNDP) in the Dominican Republic, "*the gap between the stock market price and the organic price is getting smaller and smaller. We have reached a point where organic production has lower yields than conventional production, and if no one pays the additional price, it will become cheaper to produce conventionally*" (i.e. it will become more interesting).

Finally, organic cocoa relies on segregated pathways, i.e. intermediaries throughout the supply chain must be able to ensure that organic cocoa is not contaminated or replaced by conventional cocoa. This obliges intermediaries to invest in clean infrastructure and does not allow them to benefit from the same economies of scale as industrial facilities of the major cocoa processors. Organic chocolate is therefore even more expensive and reserved for high quality gourmet chocolate bars and fine chocolate for which organic accounted for almost 13% of the market share in 2016, in comparison to the organic segment of the entire chocolate market, which is only 3% (Commod Africa, 2017b).

But there is a second obstacle to the scaling up of the supply of organic products: that of conventionalisation. This theory arose in the late 1990s in reference to the fact that organic farming is gradually moving closer to conventional agriculture, firstly in terms of its agricultural practices (monocultures, agro-industries, intensification), and secondly in terms of its economic model

FIGURE 9. Organic framing theory of change



Source: Authors.

(mass distribution, competition, race to the bottom pricing). Conventionalisation is a process that involves many changes in the organic model, including:

- The shift to mass organic farming leads to a decrease in the importance of labour and technical skills in the process towards an increasing importance of capital and access to land, that favours the most economically robust actors (Guthman, 2004; Poméon *et al.*, 2017);
- the inclusion of new actors, especially large agribusiness companies, can generate pressure to lower the entry barriers, particularly in terms of specifications and certification requirements. A development that characterizes the transition to labelling based on restricted technical specifications to the detriment of a more comprehensive approach to the organic initiative. (Poméon *et al.*, 2017)

Above all, there is a real risk that small farmers could disappear in favour of large agribusiness companies. A number of theories have suggested the possibility of a coexistence of a traditional type of organic farming, involving small producers, which remains close to its pioneering ideals, alongside a conventional type of organic agriculture that operates within industrial distribution chains. However, this theory does not stand up to history, given that we have seen on a large scale, in production basins such as California, that the development of conventionalised organic farming was accompanied not only by a greater influence of conventional distribution actors, but also by the emergence of new "giants" of organic origin, sometimes stemming from the initiatives of small producers, which have gradually become dominant in a growing marketplace, to the detriment of those who remain "small" (Guthman, 2004).

One of the anticipated consequences of the practice of higher prices for organic is the possibility of integrating externalities into its business model. Different factors are involved, according to the crops envisaged: the reduction of intensive agriculture, the preservation of wildlife habitats/field boundaries on farms, an increase in labour intensity, and the possibility of allowing the biotope to "rest" by leaving the land fallow between two cultivation phases. All these approaches incur additional costs compared to conventional farming techniques and are intended to either reduce or offset the biodiversity impacts.

However, it is not always clear that product distinction or the guarantee of quality represented by organic farming is sufficient to justify a high enough price to cover the production costs. In the end, the price formation mechanism of organic farming depends, of course, partly on production costs and producer needs, but also on the ability of the market to absorb production at this price. Ultimately, as with fair trade, the ability of organic producers to set their prices is limited by demand, both in terms of volume and of the price difference compared to the conventional alternative.

To address this issue, not all organic actors have opted for the same strategies. Part of the movement, epitomised in France, particularly by *Nature et Progres*, focuses on shortening supply channels, by favouring committed shops and purchasing centres that target a specific clientele.

In addition, most countries have public support schemes, particularly, start up funding that enable farmers to meet the investment and incremental costs associated with the transition to organic practices. In countries that lack such schemes, other actors are required to play this role, providing additional financing to enable organic farms to achieve profitability, in cases where additional market income does not always allow

for the compensation of lost productivity and increased labour costs. This is particularly the case in the Dominican Republic, where a private foundation has played the role of a third-party funder in the transition to organic farming around the Loma Quitta Espuela reserve (see below).

The capacity of organic agriculture to finance the additional costs associated with its model is the subject of considerable debate. Currently available research does not show to what extent the external contribution of capital, from public subsidies or private funding, is necessary firstly for financing the transition, and secondly for the maintenance of organic farming. In the case of cocoa, however, it seems that the organic model, for now at least, tends to enable farmers to earn a better living, but this is against a backdrop of an increasing organic supply, and therefore a potential decline in the freely traded market price, the issue is whether the financial balance will remain favourable in the absence of external cash.

Specifications that are essentially technical do not enable the preservation of biodiversity at the landscape scale

The question is whether the adopted specifications are able to guarantee the integration of negative externalities on biodiversity, in the case of cocoa, namely: deforestation, water and soil pollution, and impacts on local flora and fauna.

The IFOAM definition on its website illustrates the movement's aim to take into account all of the impacts of agriculture on biodiversity and natural ecosystems: "Organic farming is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved."[19]

But while most organic documents refer to natural ecosystems, it should be noted that, in this case, organic agriculture has historically suffered from a major gap. Indeed, the preservation of ecosystems is generally understood mainly at the level of the practices at the scale of the field. Since, as noted by De Silguy (1991, p.123), "a farm practising organic agriculture (...) constitutes a global ecological unit". The consideration of the impact of the farm in terms of land-use change, and deforestation in particular, is initially absent in most organic approaches, even if we can assume that organic farmers will be concerned about these matters.

The move towards labelling and mainly technical specifications (lists of products or practices excluded) in the 1990s reinforced this gap, since the qualitative consideration of a landscape environment, which is also beyond the direct control of the farmer, is absent.

Thus, if the benefits of organic cocoa farming in terms of biodiversity conservation on the plantation and in the immediate environment are recognised (preservation of insects, plants, soils and streams) (ICCO, 2006; Jacobi *et al.*, 2014), the issue of combating deforestation, which is one of the major impacts of cocoa production on biodiversity, is not well addressed in reference papers and studies.

However, it should be noted that in IFOAM's principles and standards for organic farming, which it revised in 2014 (IFOAM, 2014), the idea of landscape preservation has been integrated, particularly for forests in 2.1.1 and 2.2.2. In particular it states that "*operators shall take measures to maintain and improve landscape*" or that "*farming areas installed on land that has been obtained by clearing of High Conservation Value Areas in the preceding five years shall not be considered compliant with this standard*."

Similarly, IFOAM states: "*Those who produce, process, trade or consume organic products should protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water*."[20]

However, the reality of the specifications continues to favour action that is very localised at the plantation level, and "landscape" criteria remain weak. The non-conversion of HCV (High Conservation Value Areas: areas that are important for flora and fauna conservation, or due to their cultural significance) is a bare minimum measure, that only allows for the consideration of biodiversity plots, without taking the ecological continuity of landscapes into account. As for the five year delay, it is extremely inefficient since it is "moving" in time. An area that should not be cleared can become "convertible" from one year to the next. In the absence of a fixed baseline year, these criteria are therefore insufficient to ensure they provide an effective defence against the conversion of landscapes with high biodiversity value.

As noted by Tayleur & Phalan (2016): "the USDA's organic standard[21], which is widely applied worldwide, has failed to prevent deforestation for organic sugar production in Paraguay."

This happens because organic farming from the outset has focused mainly on the ecological balance at the field level. For example, Howard and Steiner, two organic farming pioneers, consider that the organic matter cycle is the critical factor, and they focus on soil and humus quality, along with the development of theories around composting. The extremely restrictive definition of organic farming in the Agricultural Orientation Act of 4 July 1980 is along the same lines: "an agriculture that does not use any synthetic products."

However, while the existing organic farming specifications may seem insufficient as a tool for the preservation of biodiversity at the landscape or territorial level, their effectiveness at the field level is without doubt, where they enable the maintenance of soil qualities and prevent the build up of pesticide residues in the environment and in water (De Silguy, 1991).

19 IFOAM definition from 2008: www.ifoam.org reported by Leroux (2011).

20 www.ifoam.bio/

21 United States Agricultural Department, which manages the specification of organic agriculture in the United States. This specification is a reference for many certification bodies, well beyond the US borders.

Especially when organic is associated with agroforestry. Thus, Jacobi *et al.* (2014) noted that tree species diversity in organic cocoa plantations was higher than in non-certified plots. Similarly, our field studies in Ghana suggest that organic plots have greater animal and plant diversity and better soil quality.

It could also be considered that, although the specifications are not rigid on the question of landscape preservation, this aspect remains an issue for the proponents of a "traditional" form of organic agriculture, of a "lifestyle" type, who envisage their activity as a global approach, while "conventionalised" organic tends not to worry about it, since it is not integrated into the technical specifications. Indeed, the motives of farmers are diverse: some seek to reduce their exposure to toxic chemicals, or that of their livestock, others are more concerned about an economic premium or the quest for productivity. However, most also cite ethics and the search for a balance with nature. "They are therefore driven by a genuine ideal, which goes far beyond the use or non-use of synthetic chemicals," noted De Silguy (1991, p.19).

It is worth emphasizing the originality of the approach adopted by the Loma Quita Espuela Foundation in the Dominican Republic, that we visited as part of this study. In the late 1990s, following the devastation of cocoa farms by Cyclone George, the Foundation developed an ambitious programme based on the economic potential of the organic sector, which was then in full development. The idea was to make contracts with cocoa farmers near the Loma Quita Espuela reserve in the north of the country. In exchange for support for transitioning to organic farming, and to be connected with a Swiss organic cocoa buyer, the producers gave up a proportion of their plots located inside the reserve. This successful initiative is a good example of how the commercial benefits of the organic approach offset the costs associated with mitigating the production method externalities. However, it also shows that outside support is needed for this transition phase, and that the theory is only valid when there is a large enough market that is sufficiently profitable for producers.

In conclusion, while organic farming provides strong guarantees in terms of biodiversity protection at the plot scale, its current modalities, and especially those that develop with the arrival of new actors on the market, do not offer sufficient guarantees to integrate the agricultural land in a protected environment, or to protect the surrounding territories from agricultural expansion, particularly to the detriment of forests.

Moreover, the theory of change for organic agriculture strongly depends on the capacity of the sector to finance the additional costs related to the integration of externalities, without discouraging farmers with the prospect of significantly declining incomes. In other words, in a competitive model where conventional agriculture remains both more productive and more profitable, it must convince its customers to pay a much higher price than the rest of the market and/or rely on external financing, in the form of public or private funding. Organic agriculture's ability to gain market share must therefore be achieved while maintaining this fragile balance. Especially in countries where the public authorities lack the means to provide this support.

Thus, as is also true for fair trade, organic farming, despite its laudable intentions and the effectiveness of some of its provisions, does not in itself provide an adequate solution for the challenge of protecting biodiversity on the scale of global cocoa production. Perhaps another key factor here is that these agricultural principles were developed in countries of the "North", where agriculture had already consumed natural spaces and the economic model was not based on massive exportation.

2.2. Initiatives focused on companies

2.2.1. Rainforest alliance: sustainability or productivity?

Created by Daniel Katz in 1986, the initial goal of Rainforest Alliance (RA) was the protection of forests, in view of the accelerating deforestation rate in the 1980s. It proposed to support companies selling wood or agricultural raw materials in a process of improving their environmental impact. In 1990, the association rolled out its first forestry certifications. Commodities such as bananas followed in 1992, coffee in 1995, and cocoa in 1997. In 1998, it led to the creation of the Sustainable Agriculture Network (SAN), a network of actors committed to sustainable agriculture, which became the guarantor of Rainforest Alliance certification standards. From then on, RA certification became known as SAN/RA.

This certification system went on to become a major worldwide success, especially for tropical agricultural products such as tea, coffee and cocoa.

In 2015, SAN/RA certified 11.8% of global cocoa production. In 2017, the SAN/RA alliance was reorganised, with the certification system and label being fully assimilated by RA, while SAN relinquished its certification role to focus on a new objective of supporting companies towards sustainability, without necessarily entailing certification.

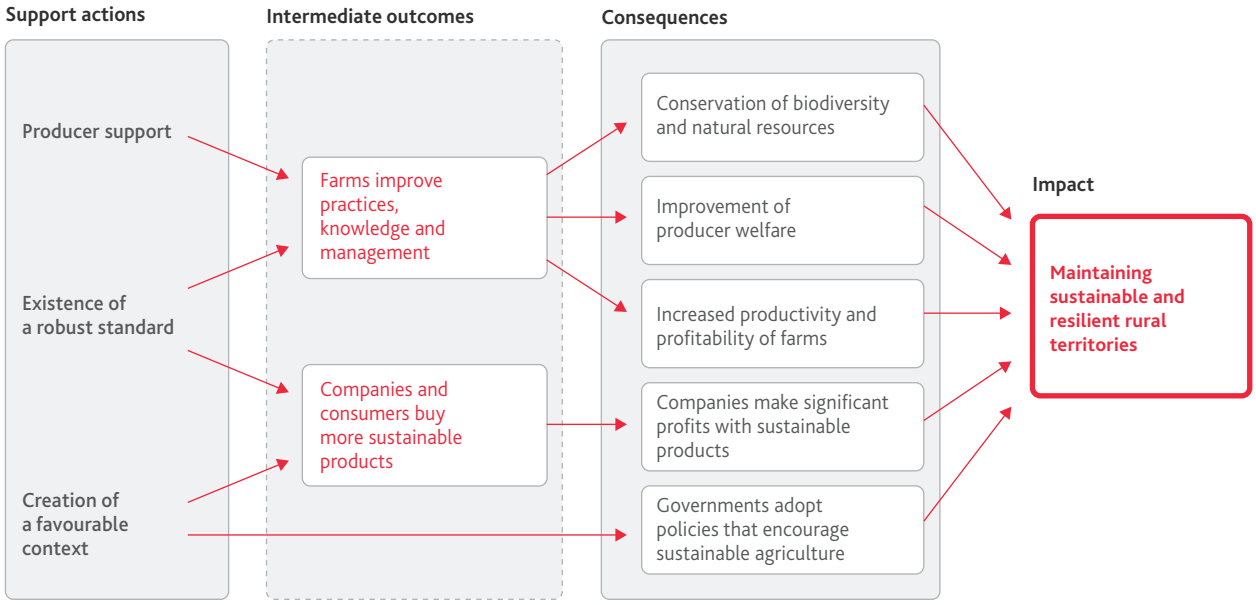
In 2018, the Rainforest Alliance announced its merger with UTZ, a label created in the Netherlands in 1997, which offers "quality" certification while also including environmental aspects. In 2015, UTZ certified nearly 21% of global production (ITC, 2017). The newly merged entity covers nearly a third of global cocoa production through its various certification schemes.

Hereinafter, we use the abbreviation SAN/RA to designate Rainforest Alliance certification up to 2017, and RA to refer to the new entity formed by the merger with UTZ in 2018.

It should be noted that both certification systems (UTZ and SAN/RA) remain in force, and that an update of the standard is underway, although at this stage it is not certain whether this new standard will apply to all RA products. For simplicity we mainly examine the SAN/RA standard in this paper.

The RA certification is based on five principles with sets of criteria to determine compliance. These specifications are generally adapted at the local level, with companies given some leeway to adapt certain criteria according to their needs and specificities. For example, a "regional" version has been developed by Ivory Coast cocoa exporters (Lemeilleur *et al.*, 2015).

FIGURE 10. Rainforest Alliance theory of change



Source: Authors, adapted from Milder & Newsom (2015).

The 5 SAN/RA principles are:

1. Effective planning and farm management systems;
2. Biodiversity conservation;
3. Natural resource conservation;
4. Improved livelihoods and human well-being;
5. Sustainable livestock farming

Furthermore, since 2016, RA has developed a continuous improvement concept. The aim is to consider that certification no longer responds to the obligation of achieving a result, in which the achievement of a certain number of criteria makes it possible to obtain the label, but is more of an obligation of means. Involvement in a process of improvement makes it possible to benefit from the label, even if all of the criterias have not yet been achieved. A company then enters an improvement stage where it must show annual progress regarding its implementation of the standard.

Being awarded with the label depends on the ability to fulfil the criteria contained in the five principles. This capability is verified by an external audit. The costs of the audit are borne by the producers themselves. Intermediaries wishing to market certified products must pay royalties to RA. Adherence to the standard can be done either individually or as part of a group (cooperative or producer association).

On the other hand, RA certification is not accompanied by a minimum price or a lump sum bonus. The standard anticipates that market mechanisms will encourage labelling. Particularly by securing the sale to buyers that are more reliable than the buyers of the traditional market.[22]

Concerning biodiversity conservation, the SAN/RA standard calls for HCV areas to be respected, but also HCS (High Carbon Stock)[23] zones, making it one of the most demanding standards regarding deforestation. This was recognised in a World Bank study in 2017 (Kroeger, Bakhtary, Haupt, & Streck, 2017). In addition to these specifications, the label demands a minimum shade level depending on the crop type: for example, for cocoa the canopy must cover at least 30% of the area, and have at least five different tree species per hectare (RA 2017, 23).

It must be emphasised that the goal of the Rainforest Alliance is the preservation of forests through market mobilisation. As RA explains on its website: "We are harnessing the power of the market to drive positive social, environmental, and economic change along entire supply chains, across landscapes that are critically important to our climate stability."

Therefore, it is not so much about supporting producers, or trying to change the market rules. In this sense, as Doussin (2008) highlighted: "It is thus a business-oriented approach, combined with a process of social responsibility, rather than a support for the capacity development of producer organisations (small farmers or plantation workers)."

22 Rainforest Alliance website https://www.rainforest-alliance.org/approach

23 The HCS methodology, developed by Golden Agri Resources, TFT and Greenpeace, consists in mapping a forest area according to the amount of carbon stored in the aboveground biomass (plants). A stratification method is then applied to divide the area by distinguishing six types of vegetation cover, from the least to the most carbon rich. This methodology enables the identification of areas likely to be converted into agricultural plantations and those that will be preserved. The methodology also takes biodiversity criteria and social criteria into account, in addition to the amount of carbon. See http://highcarbonstock.org/ the-high-carbon-stock-approach/

While RA's theory of change is clearly explained in the literature about the standard (Rainforest Alliance, 2017), even more detail is provided in a 2015 impact report (Milder & Newsom, 2015). We have used these documents as a basis for drawing up a simplified version of this TOC (**Figure 10**).

The RA TOC is therefore based on two main intermediate outcomes, which are divided into five consequences that are intended to lead to the desired change.

The first of these outcomes, which is at the heart of the RA strategy, involves improving the performance of producers. These improvements can be broken down into three main categories: improving agricultural practices (towards greater sustainability and more productivity); improvement of knowledge; improved management of operations (budget, team management, planning, investment...).

The few available studies on the subject find contrasting conclusions. Ochieng *et al.* (2013) and Waarts *et al.* (2012) both agree that the standard has been effective at increasing farmer knowledge. The training provided through support programmes seems to be achieving benefits, and farmers and farm workers from certified farms demonstrate a better knowledge of sustainable production issues and the available tools to improve farming practices.

Regarding the practices themselves, the conclusions are less favourable. The study by Ochieng *et al.* (2013), conducted on Kenyan tea farms, showed that certain measures are implemented (buffer zone establishment, distribution of safety equipment), but that most remain theoretical: for example, obligations of the specifications regarding the number of native trees per hectare and the presence of wooded areas on the farm were not met. Lemeilleur *et al.* (2015) noted that buffer zones associated with Ivory Coast cocoa farms were not demarcated or therefore respected. Regarding the biodiversity impact, Bellamy *et al.* (2016) found no difference between RA-certified banana plantations and non-certified plantations.

Above all, many of the practices required by the specifications are related to farm management, with a view to improving productivity. Not all of these practices are necessary to achieve sustainability and in some cases such practices are even rather dubious in terms of their compatibility with the sustainability objective, such as the encouragement of fertilizer use in plantations. In addition, the drive for productivity is presented as a tool for increasing farmer income, a theory that is certainly questionable, since increasing productivity does not automatically result in an equivalent increase in net income, given the cost of inputs that may be needed, and even more so in an open market characterised by structural overproduction.

With regard to improving management, there are few studies that really show whether changes in practices are effective. On the other hand, their impact on producer income and standard of living is generally limited. The balance between the costs associated with certification (the cost of audits, extra work and additional investment) and the additional revenue generated seem rather unfavourable (Waarts *et al.*, 2012). And when incomes are increased, they do not always reach the level of the minimum wage in the countries concerned, which is nevertheless one of the obligatory certification criteria (Ochieng *et al.*, 2013). Above all, Lemeilleur *et al.* (2015) noted that the social criteria set out by RA are generally a reformulation of regulations that are already applicable, either derived from national legislation or from international conventions to which the country is a signatory. In other words, these criteria do not necessarily provide any additional guarantees, except that of the external audit which would make it possible to check compliance with these criteria. It is these audits that particularly attracted the attention of Lemeilleur *et al.* They showed that during these audits, the auditors do not give the same importance to all criteria. In particular, they observed that the auditors give priority to farm compliance with quality and productivity criteria that exporters have added to the specifications, and that little attention is given to environmental and social criteria. This distortion of the certification system due to auditor subjectivity radically transforms the original aim of protecting natural areas, making RA certification more of a useful tool for productivity, rather than sustainability.

This distortion is made possible because it is above all the exporters in the producing countries who promote certification and who encourage producers to participate. They then progressively add their own criteria to the specifications, as the standard permits. These criteria focus on product quality, standardisation and productivity levels. To encourage producers to enter a certification process, in the absence of a premium, they offer a purchase guarantee, through exclusive contracts, which benefits producers by reducing the uncertainty around selling their harvest.

The question of non-compliance with standards, which has been regularly highlighted, is particularly problematic, since the standard's "robustness" is regarded in the TOC as an indispensable element for its two main intermediate outcomes. The RA itself admits that it has had to downgrade the criteria of its standard by developing the concept of continuous improvement (SIANI, 2019).

Concerning the second intermediate outcome, the same problem arises, since this outcome relates to the purchase of "sustainable" products by companies and consumers. However, the sustainability of products ultimately depends on the robustness and reliability of the standard. In addition, the measures that RA has implemented to encourage the purchase of sustainable products are not detailed enough.

There are two practices in particular that raise questions. The first is the practice of "mass balance", which, for sectors where certified produce is mixed with non-certified produce, involves the application of a rule of equivalence between the amount of non-processed certified produce which "enters" into the processing cycle, and the amount of processed produce that "comes out" and will receive certification. For the cocoa sector, RA is facing a bottleneck—there are very few actors, and these actors operate very large processing units that cannot segregate their supplies, or do not want to, according to origins and different modes of production (see above). The main consequence of this practice is that the consumer has no guarantee that the product he or she buys or consumes has actually been produced according to the rules of the standard, but only that

an equivalent quantity has been produced. This encourages the coexistence of production chains that are not comparable in terms of sustainability. A second consequence is a lack of product traceability. By purchasing a certified product, the consumer is in fact funding a supply chain and its intermediaries who are also involved in the marketing and processing of "unsustainable" products, while the absence of segregation means there is no incentive for companies to improve the traceability of their supply chains.

Finally, one of the RA rules states that a product may be authorised to bear the standard, even if only 30% of raw material in the product is in compliance with the specifications. However, this concession is accompanied by an obligation to increase, within a reasonable time frame, the proportion of certified content in the finished product. In the meantime, the "sustainable" quality of the product sold remains questionable.

The promise of difference proposed by RA is not always easy to determine. Lemeilleur *et al.* noted that the irrelevance of certain criteria when applied to cocoa production serves to confuse the message, or that the promise made to the consumer is impossible to satisfy, since some criteria are simply beyond the reach of producers (such as the improvement of local healthcare, or the protection of water resources that depend on collective local management). In addition, there are weaknesses in monitoring and a lack of sanctions for when contraventions occur, which contribute to lowering the requirements of the standard.

A last element of the RA's TOC claims that the standard creates a "favourable context" that encourages governments to adopt sustainable production measures. The way in which this inducement should operate is not very detailed. Moreover, it is striking that an intermediate outcome seems to be "missing" from the TOC, one that links the support action to its consequence. It is, however, conceivable that the logical framework of the TOC analysis may not always be adaptable to all approaches. However, the question is to what extent can recent government announcements in producing countries (Ghana, Ivory Coast) (Commod Africa, 2019) and in importing countries (Europe), regarding the deployment of frameworks intended to encourage the sustainability of the cocoa/chocolate sector, be explained by the support actions of labels such as SAN/RA. At best, we see the pioneering nature of these approaches in demonstrating the commercial viability of so-called sustainable products.

Moreover, as mentioned earlier in the fair trade section, most state initiatives in recent years do not impose binding criteria, but rather voluntary "incentives", which for the main part have a particular impact on supporting the development of labelled sectors, the most important of which is... Rainforest Alliance. Consequently, these measures encourage sustainable agriculture only to the extent that these labels are, in fact, able to guarantee the sustainability of their producers' practices.

In conclusion, we note that the Rainforest Alliance theory of change is characterised by a certain vagueness in the links between its various elements, which makes the evaluation of its transformative nature rather difficult. If we focus on statistical performance, however, the approach is undeniably successful in terms of enlisting producers, but its ability to protect biodiversity in agricultural and surrounding ecosystems is far from proven. Indeed, the recognised quality of the criteria that make up the initial specifications is undermined by the flexibility of the audits and evaluations, which gives producers considerable leeway and prioritizes non-environmental criteria, in addition to which there are few means of control. Finally, given that the position of mid-chain actors is central to the promotion and implementation of certification, the approach is subject to a general bias towards quality and productivity, at the expense of sustainable production. Under these conditions, there is a risk, as noted by Lemeilleur *et al.* (2015), that the RA label becomes a tool for improving productivity "in the name of sustainability".

2.2.2. Corporate Policies: The Holy Grail of Productivity

In addition to certification procedures, there has been an emergence in recent years of an increasing number of so-called "voluntary" initiatives, initiated by cocoa-chocolate companies. These approaches take the form of internal policies or programmes run by companies themselves, sometimes in partnership with NGOs or public institutions. They aim to improve the "sustainability" of the company's activities, but also to differentiate the products offered to consumers by demonstrating virtuous qualities.

These voluntary commitments (VCs) can either be associated with more traditional certification approaches or can replace them. They form part of corporate social responsibility (CSR) and corporate environmental responsibility (CER) policies, where companies themselves take responsibility for mitigating their impacts and improving their practices without the need for binding regulations or the organisation of monitoring. This logic has been at the heart of CSR development since the early 2000s, particularly following the signing of the Global Compact in 2000, which is a non-binding agreement signed under the auspices of the United Nations, whereby multinational companies are encouraged to ensure their activities respect human and environmental rights.[24]

Almost all cocoa/chocolate companies have developed voluntary commitment programmes of one form or another. In our study we focused on four VC strategies. The first of which is the approach of Barry Callebaut (Forever Chocolate): this Swiss company is a key player in the sector, manufacturing 40% of the couverture chocolate subsequently used by confectioners, which makes it by far the dominant actor in this part of the supply chain. We also studied the VCs of the three main confectioners: Mondelez (Cocoa Life), Nestlé (Cocoa Plan), and Mars (Cocoa for Generations), which together account for more than a third of the world's chocolate confectionery sales.

24 https://www.unglobalcompact.org

Voluntary commitments with relatively similar content

Launched in 2016, the Barry Callebaut **Forever Chocolate** programme aims to "make sustainability the norm".[25] It sets four targets to achieve by 2025:

1. to eradicate child labour from the supply chain;
2. to lift 500,000 cocoa farmers out of poverty;
3. to become carbon neutral and forest positive;
4. to offer 100% sustainable ingredients in all products.

To achieve these objectives, the programme relies on direct action with producers, on efforts to work directly with specific suppliers, and on forming partnerships with the rest of the sector within the World Cocoa Foundation and with other international organisations through two foundations: the Cocoa Horizons Foundation and the Jacobs Foundation (which relies on Jacobs Holding, one of Barry Callebaut's main shareholders).

Implemented projects mainly involve supporting producers to modify their practices through training and the supply of equipment and seeds. Other projects complement this assistance, such as programmes on access to education and tree planting for shade, and efforts on the sector, a direct sourcing project through its subsidiary Bioland, and finally measures to reduce the carbon footprint of the supply chain.

Launched in 2012, Nestlé's **Cocoa Plan** initially consisted of a series of mainly social measures. It is based on three pillars:

1. better agriculture;
2. better lives;
3. better cocoa.

Essentially based on increasing farm productivity and cocoa quality, this programme aims to improve the standard of living of producers, eradicate child labour, and improve cocoa processing. It operates by providing programmes to support and train producers and programmes on access to education. Nestlé products produced through the programme are labelled with the Cocoa Plan logo, allowing consumers to distinguish these products from others. In 2019, in addition to the measures set out in the Cocoa Plan, Nestlé adopted an action plan against deforestation, in line with its commitments made under the "Cocoa and Forest initiative", which aims to map farms participating in the Cocoa Plan, to implement measures to exclude suppliers in the event of illegal deforestation, to run training programmes and undertake awareness raising among producers, and to facilitate access to credit for farmers (Nestlé, 2019).

Mondelez's **Cocoa Life** capacity-building programme was established in 2012. It aims to support 200,000 cocoa farmers by 2020. The programme focuses on five themes:

1. agriculture;
2. community;
3. youth;
4. livelihoods;
5. environment.

These themes shape the objectives of a range of projects that include training farmers in more sustainable practices, facilitating access to education, planting shade trees, and the mapping of all farms registered in the programme.

It also encourages payments for environmental services (PES). The company supports communities in the development of territorial management plans; it uses satellite images to monitor the changes in forest cover in an area; and a community receives financial compensation if it adheres to its commitments. The programme also aims to map all participating farms.

In 2019, Mondelez published an action plan incorporating most of the commitments covered by Cocoa Life, along with an exclusion mechanism for suppliers involved in illegal deforestation.

Mars launched its **Cocoa for Generations** programme in 2018. Its stated objective is to achieve 100% sustainable and traceable cocoa by 2025. It has two pillars: a "short term" programme called Responsible Cocoa Today, and a longer-term one called Sustainable Cocoa Tomorrow.

The first pillar has three components:

1. protect children;
2. preserve forests;
3. improve farmer income.

The second pillar also has three objectives:

1. improve productivity;
2. diversify income;
3. empower women and communities.

The various projects within the programme include access to education, the intensification of production, the mapping of farms in the programme, providing training for farmers, facilitating access to credit, and the encouragement of agroforestry.

It is clear that the VCs of the four companies studied have many similarities. They certainly have similar objectives (fighting against child labour, supporting producer communities, and implementing programmes to fight against deforestation) and philosophies, particularly the emphasis given to farmer training and increasing productivity.

Another shared feature of these commitments is that only very low levels of detail pertaining to them are available in accessible public documents. The content provided by the relevant websites and the few available reports often only concerns intentions and progress indicators, without explaining the functioning of the mechanisms intended to usher cocoa production towards an acceptable level of sustainability. In the same vein, the sustainable or responsible nature of cocoa is undefined and most progress indicators are macroeconomic (number of producers above the poverty line, number of reforested hectares, productivity level, etc.), while the technical and environmental criteria for defining sustainable production are not detailed, contrary to the extremely precise specifications of third-party labelling schemes. A glaring example of this observation is the lack of a definition of sustainable agroforestry in programmes that cite agroforestry as a desirable endpoint. In the absence of a precise definition, agroforestry can cover a wide range of realities, most of which are incompatible with biodiversity preservation (Amiel *et al.*, 2018).

25 Barry Callebaut website: https://www.barry-callebaut. com/en/group/forever-chocolate/forever-chocolate-strategy/thats-what-forever-chocolate-all-about

Finally, the juxtaposition of projects and objectives that concern different levels of intervention and time scales, such as farmer training, the reduction of child labour, and the reduction of deforestation, makes it difficult to identify an explicit theory of change. However, by studying the available documents and the information provided by the websites of the companies and their programmes, we were able to summarize a theory of change that is shared by these four programmes (**Figure 11**).

This overview enables the differentiation of these programmes according to their support for intermediate results and their impacts. It reveals a theory of change based on four intermediate outcomes: the reduction of child labour, the intensification of production, the development of agroforestry, and the exclusion of farms involved in illegal deforestation.

The first intermediate outcome, the reduction of child labour, is in fact a long-standing commitment of all of these companies, triggered by major whistle-blowing campaigns dating back to the early 2000s. Long before the environmental aspects of cocoa production were considered to be an issue, the sector has made child protection the subject of collective commitments, particularly as part of the International Cocoa Initiative (ICI). If the problem remains far from solved after several years of commitments and initiatives, then it is due to the frequent difficulty in distinguishing the different forms of child labour: slavery, employment of minors as agricultural workers or "family workers". For this reason, companies have avoided the implementation of strict policies prohibiting the employment of minors in cocoa plantations, despite the existence of international agreements and legislation that does just that. Instead, chocolate companies have put their hopes firstly on promoting education, on the basis that children in education are less likely to work on plantations, and secondly, on increasing farmer incomes, to enable the employment of a more qualified and wage-earning workforce, thereby reducing the need for child labour (which is related to the idea that incomes can be improved by increasing productivity, which is analysed in more detail below).

The advantage of using the development of education as a lever is that it is widely regarded as an effective tool for addressing the problem of child labour. However, it is clear that after years of effort, the problem has by no means been solved, which the companies themselves freely admit. In addition, this approach positions the problem as a societal issue, which partly relieves companies of their responsibility to safeguard the working conditions of their suppliers. Finally, despite the small number of schools and scholarships that these programmes provide, it is evident that the situation cannot be resolved without public administrations in producing countries making a significant commitment to educational programmes.

In addition, certain elements of these programmes attract a level of criticism. For example, Barry Callebaut highlights the fact that one of its largest shareholders, Jacobs Holding, uses funds to support educational programmes in Switzerland, as well as in cocoa producing countries. According to the annual reports of the Jacobs Foundation, which manages these programmes, nearly a third of the foundation's budget (8 million Swiss francs) goes into the TRECC programme, which aims to improve the standard of living in cocoa farming communities, particularly through technical training to improve the management capacity and productivity of cocoa farmers (Jacobs Foundation, 2019).

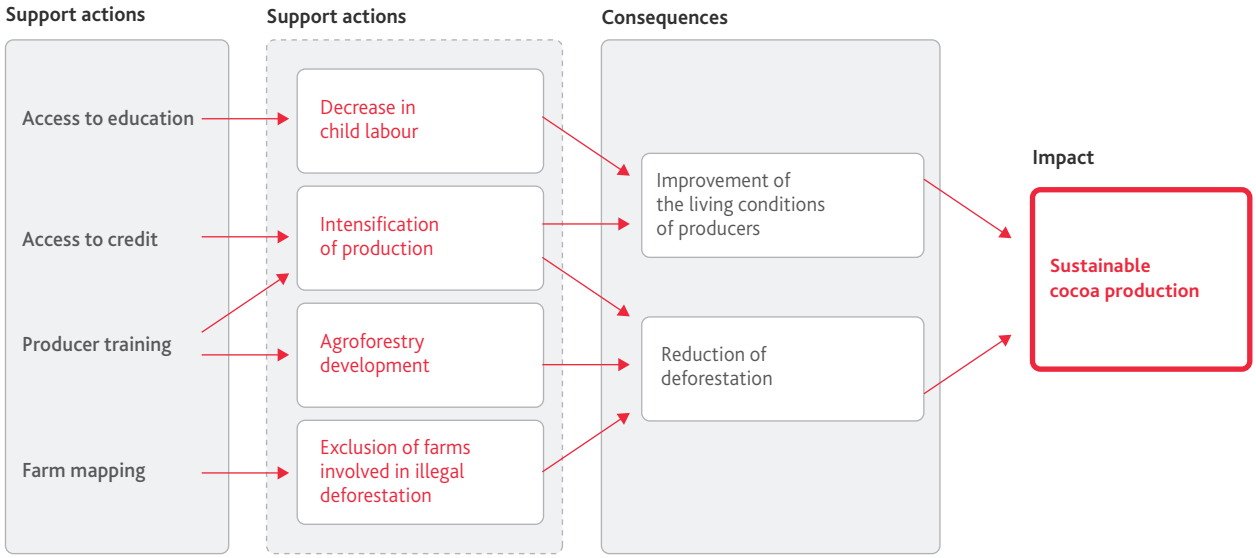
The second intermediate result concerns the intensification of production. The message repeated across more or less all company literature is that there is a need to "produce more cocoa on less land". Intensification is seen as a response to almost all sustainability issues. Intensification would not only increase farmer income by increasing the quantities sold, thus lifting them out of poverty, but it would also reduce child labour through the mechanisms outlined above. This would then automatically reduce pressure on ecosystems by removing the necessity for plantations to expand (for constant production volumes, and therefore constant demand). Finally, the corporate literature expects intensification to promote the development of agroforestry, since farmers will have space to plant more shade trees or auxiliary crops, without lowering yields at the farm level. As shown in **Figure 11**, intensification is therefore central to the TOCs of corporate VCs. It is not surprising that these are the main levers identified by the industry. Indeed, in addition to the alleged advantages of intensification for the sustainability of production, it enables, through sustainability commitments, the provision of a response and a guarantee against the expectations and fears of the sector in terms of supply, particularly in a context where the companies regularly warn about cocoa supply crises or even shortages. Indeed, Barry Callebaut's in-house motto appears to be "sustainability and availability".[26] By emphasizing intensification as the key to their programmes, the companies claim they are addressing both consumer demand for more sustainable cocoa, along with their own needs for long-term supply guarantees.

However, this line of reasoning from a TOC perspective deserves to be questioned. Firstly, the link between increased productivity and increased income is far from automatic. Of course, at the farm level, the low yields obtained in the main producing countries of Ivory Coast and Ghana suggest that there is a significant margin for productivity improvement, which could in fact benefit the producer. However, looking at the sector as a whole, we see that it is regularly in a situation of overproduction, and that sharp drops in cocoa prices are one of the consequences of more production. It is hard to imagine that a major productivity boost would not have an overall negative effect on prices, which would greatly reduce the benefits of this increase for producers.

Companies engaged in sustainability programmes tend to dismiss this argument on the grounds that extra income would outweigh any fall in sales and that the benefits of intensification are multiple (see below). At the same time, they tend to reject the idea of increasing the purchase price paid to farmers, arguing that this is more of a cosmetic measure and again highlighting

26 Personal communication from a Barry Callebaut corporate partner, November 2018.

FIGURE 11. Theory of change of corporate voluntary commitments from Mondelez, Mars, Nestlé and Barry Callebaut



Source: Authors, from the websites of Mars, Barry Callbaut, Nestlé and Nestlé Cocoa Plan, Mondelez and Cocoa Life, Mondelez International (ND), and Nestlé (2019).

the low yields obtained from many plantations. This belief is perfectly illustrated by a comment on the subject of fair trade made by a Nestlé representative: "They are gradually becoming civil servants, they no longer put in the effort. Conversely, when production increases, the standard of living increases. It's better than having a minimum price."[27]

However, studies have shown that the benefits of agricultural intensification for biodiversity are far from proven. In the case of export commodities, they may even be unfavourable by encouraging deforestation in the absence of strong governance of land and natural resources (IPBES, 2019, chapter 2, p.117). These negative consequences of intensification would be particularly strong in situations where it is the market that encourages intensification (Byerlee, Stevenson, & Villoria, 2014).

The theory of change approach offers us a renewed perspective in this respect. Indeed, by reconnecting the various projects that focus on intensification (increase in income, deforestation decrease, development of agroforestry) within the same causal chain, it highlights several contradictions inherent to a TOC that is often little explained, or not at all. Thus, the intensification of production is intended to not only meet the need to improve farmer incomes, but also to create a virtuous circle by enabling farmers to employ workers, rather than rely on family help (child labour). However, from the point of view of management, if intensification results in a rise in income, then the farmer will need to consider whether to invest additional income by hiring farm workers, or to keep this additional amount as annuity income. While these two directions are not totally incompatible, the achievement of both objectives would require a more than substantial increase in production, so that this additional income, minus a possible fall in cocoa prices, is sufficient both to pay additional wages and to increase the farmer's disposable income.

Similarly, intensification is considered to have the capacity to reduce the spatial pressure on forest landscapes and to clear space within fields for the planting of shade trees in an agroforestry dynamic. This dual purpose may seem paradoxical. Can the producer both agree to devote part of the benefits of intensification to reduce the number of trees per hectare and, at the same time, give up an extension of his plantations into the forest to keep the same income?

Finally, in a similar way, the question arises as to whether a farmer can use the benefits of intensification to both compensate for the cultivation area lost due to forest conservation and the development of agroforestry, as well as increase his income. In fact, by assigning multiple objectives to a single agronomic instrument, the TOC of corporate VCs neglects the fact that producers will have to make trade-offs in terms of reinvesting their productivity gains. Given that most of these farmers live in poverty, it is unlikely that a possible increase in income from the sale of products will at the same time meet all of the social and environmental challenges it is expected to address. In any case, there is certainly a need for a more in-depth examination of the relevance of the assumptions made by corporate VCs regarding the expected consequences of intensification, particularly from an environmental and agricultural management point of view.

Moreover, and this is critical from a biodiversity perspective, the agronomic and environmental limits to intensification do not seem to be considered in these hypotheses. Indeed, intensification requires the use of inputs, different farming techniques, the use of so-called "improved" seeds and, in some cases, a number

27 Personal comment, October 2017.

of plant protection products. In addition to the fact that intensification is not in itself a factor that reduces the pressure on land use, questions must be raised about its impact on natural resources, both on the plantation and in the surrounding landscape: possible degradation of soil quality, water cycles, impact on pollinators.

In this respect, Mondelez's approach that incorporates the idea of payments for environmental services deserves special attention. Indeed, by offering another way of remunerating ecosystem preservation, it makes it possible to reduce the necessary trade-offs on the possible productivity gains to only the social and economic issues of the production unit. On the condition, however, that the payments are sufficient to cover the potential opportunity costs related to the conservation of these natural areas, as well as the costs associated with the management of the programme (mapping, boundaries, monitoring...).

The third intermediate outcome of the VC's TOC is the development of agroforestry as a more sustainable and resilient production mode in comparison to cocoa monoculture. This element of the TOC lacks clear definition of the mobilised concepts. Indeed, most examples of so-called "agroforestry" in cocoa production areas, particularly West Africa, are simple low-shade agroforestry systems, the benefits of which from a biodiversity perspective remain extremely limited. Only complex agroforestry with a high level of shading has sufficiently ambitious characteristics, although it pales in comparison with the maintenance of natural forest ecosystems (Amiel *et al.*, 2018). The development of agroforestry cannot therefore compensate for existing deforestation, and cannot replace programmes for the preservation of natural ecosystems. In addition, it is essential that ambitious targets are set in terms of the replanting and restoration of agricultural ecosystems, and yet nothing in the publicly-available literature from these companies attests to the level of ambition of this framework. Presenting the development of agroforestry as a tool against deforestation therefore seems totally inappropriate.

The fourth intermediate outcome is post-market expulsion procedures for producers that have carried out illegal deforestation, including in protected areas and forests. In fact, this is very much a counterpart to the commitments of Ivory Coast and Ghana to take firm action against such unlawful expansions. The problem is that companies usually have no way of knowing which producers supply them with cocoa. As we have previously seen, the sector's logistical organisation does not at present allow traceability down to the field level. For example, Barry Callebaut owns a direct supply subsidiary: Bioland. This ensures a supply of directly sourced cocoa from 45,000 farmers. However, Barry Callebaut estimates that its total supply is derived from nearly one million producers (Yu, 2017). Therefore, to terminate contracts with illegally-operating producers, companies are only able to rely on external reports, such as those provided by NGOs which, by moving from the deforestation zone down towards the different intermediaries (as opposed to going up the channel which is much more complicated), can reveal the presence of illegal cocoa in the supply chains of companies (for example: Higonnet *et al.*, 2017).

Indeed, the companies all operate deforestation monitoring systems based on satellite imagery, but given that they do not know from which producers they source, their solution is to map the farms of the producers to whom they provide support, through their training programmes for example. In fact, due to the lack of complete traceability of their supplies, companies seem to support selected producers and producer groups on a more or less "random" basis. As an interviewer at Nestlé admitted, companies have no way of knowing for sure whether the producers they choose for their programmes are part of their own supply chains.[28]

The importance of this mapping work cannot be understated, especially given the improvement in land use data that is now available in producing countries, and its potential application to combat the disappearance of the last intact ecosystems. However, it should be noted that in the absence of effective traceability, the threats of exclusion made by companies risk being something of a dead letter, and, consequently, that the fight against illegal deforestation by the main industry players seems inadequate.

In conclusion, while certain elements of the VCs of the four companies, taken separately, are of interest, such as access to education programmes and mapping efforts, their effectiveness as part of a general theory of improving the sector's sustainability is dubious given the current state of affairs. By failing to consider the production system as a whole, where every action has a consequence on several factors, these programmes put too much faith in the idea that intensification will bring about transformation. Ultimately, by improving farmer training, companies have developed sustainability policies that meet their own expectations in terms of production. By shifting the emphasis onto farmers and their responsibilities in terms of the practices they implement, they are shirking their own responsibilities regarding the impact of production on ecosystems and the livelihoods of their suppliers.

In addition, since the beneficiaries of chocolate company VC programmes are not necessarily tied to the physical supply chains of these companies, there is a strong feeling that companies are not so much acting in the interest of "their" producers through these programmes, or with a view to making their supply chains more virtuous, but are in fact aiming to improve the sector's yields "in general", and to better control the overall level of production. Finally, these programmes act more like an additional tool to impose constraints on producers, related to companies downstream of the chain, to induce them to conform to their productivity requirements. To the extent that the potentially detrimental consequences on ecosystems resulting from intensification are not taken into account.

Finally, a lack of definition regarding the agroforestry systems envisaged, and the impossibility, given the sector's current level of traceability, of activating exclusion mechanisms in the event of illegal deforestation, mean that the deforestation

28 Personal comment, November 2017.

components of these programmes are virtually inoperative from the point of view of biodiversity conservation (apart from Mondelez's payments for ecosystem services programme, but this currently remains at the pilot stage).

It therefore seems necessary to revise the design of these VCs. At present, they represent more of a collection of commitments made in the wake of public scandals affecting the industry, that are mainly based on the intensification of production, which is considered as a panacea for all social or environmental problems. To develop a potentially effective TOC, it will be necessary to reintroduce ideas that have been abandoned, such as the possibility of improving producer remuneration per-tonne, as proposed by FT, or the need to return to less intensive farming practices that are more compatible with the balance of ecosystems, such as organic farming.

3. CONCLUSION: ARE WE ENTERING A NEW COCOA CYCLE?

This theory of change analysis of the main mechanisms to improve sustainability in the cocoa/chocolate sector shows that none of them are currently capable of meeting the challenge of preserving biodiversity, both at the field (conservation of water, soil, fauna and flora) and the regional (fight against deforestation) levels.

The fair trade approach, despite unparalleled efforts to improve farmer income, has not yet sufficiently integrated its approach with the need for ecosystem preservation; moreover, the growing imbalance between supply and demand in the cocoa sector means that its mechanisms are becoming less and less effective from the perspective of an overall improvement in living standards, and thus also in terms of reducing ecosystem pressure by compensating for sustainable production costs.

Organic farming, on the other hand, provides effective biodiversity management mechanisms at the farm level, but does not offer mechanisms, or does so only rarely, that also maintain the ecological balance at the regional level (deforestation). In any case, its economic model depends on its ability to maintain a complex balance between increased production costs, final prices and external financial flows.

The Rainforest Alliance label (and now UTZ) seems more able to take the territorial dimension of biodiversity into account, due to the way it was created, and proposes ambitious specifications. However, the compliance requirements for its implementation modalities are too low, while biodiversity criteria are absent from its practices, and there is an absence of sanctions, which diminishes the effectiveness of their approach. Above all, the importance attached to quality and productivity in the specifications adopted by exporters shifts sustainability objectives from production to productivity.

This emphasis on productivity is reflected in the voluntary commitments of the main companies in the sector. These commitments position intensification as the solution to multiple and sometimes incompatible objectives, neglecting the potential impact of such intensification on agricultural ecosystems. Moreover, recent commitments on deforestation and agroforestry remain more of a set of intentions in the absence of rigorous definitions and adequate traceability of supplies, both of which would be necessary to act directly with suppliers.

More generally, it is striking to note that a common theme of all of these programmes is that they essentially focus on the agricultural production methods at the level of the plot of origin. As a direct consequence, sustainability instruments now serve as control instruments that are at the disposal of the downstream sector, reinforcing pressures on producers in terms of quality and productivity criteria (le Velly, 2017).

While at first glance this approach may seem logical, it ignores long-standing research findings, notably from the work of François Ruf, regarding the general dynamics of cocoa cycles and their impact on deforestation and soil degradation (Ruf , 1995). The development of cocoa has evolved in 30-year cycles that result from a complex interaction between price cycles, crop cycles and the exhaustion of "forest rent". Thirty years after the last cocoa boom in the late 1980s, all of the indications suggest that we are entering a new cocoa cycle: high price volatility, declining productivity in the main production regions, inability of farmers to invest in the renewal of plantations.

If we consider the global cocoa market as a value chain that involves all of the stages in the sector, it is therefore necessary to question the impact of demand and the downstream requirements of the sector on the strategies implemented at the local level by farmers. The industry encourages the increase of production, in spite of structural overproduction, since it seeks to maintain the very low cost of raw materials. This production pressure contributes to a never-ending search for new land, most of which is likely to be at the expense of forest, since this type of land presently has the greatest potential for rapid cocoa cultivation development by ensuring significant productivity in the early years, due to forest rent. On the other hand, the race for intensification has depleted land in the main producing countries, and in the absence of genuine policies on soil restoration and shading, these countries may no longer be able to competitively respond to the demand, thus stimulating, as occurred in the 1970s and again in the 1990s, a new shift in production areas. In other words, if Ghana and Ivory Coast fail to address the current crisis, there is a major risk that they will turn away from cocoa production and switch to more profitable crops. Forest countries such as Gabon or the Democratic Republic of Congo could then be tempted to enter into the cocoa market, running the risk of uncontrolled deforestation.

It is therefore necessary to question firstly the possible conditions of intensification that would be compatible with the maintenance and restoration of ecosystems, and secondly whether continuous pressure from rising global demand can be compatible with the zero deforestation policies that have been almost universally adopted by the industry in the last three years.

Ultimately, the issue is whether companies in the middle of the supply chain, beyond the demands they place on their

suppliers, are able to impose certain requirements on their own practices in terms of the sustainability of the cocoa they buy, and therefore on the chocolate they produce. These requirements could be of several types. Initially, it would involve a willingness to adapt their processing methods towards sustainable production: better segregation of supplies, favouring supplies from controlled origins, and consequently by developing direct or at least traceable, suppliers. Secondly, there needs to be a rethinking of the sector's economic model, which can no longer be structured according to the demand for chocolate and chocolate products, but according to a sustainable cocoa supply. Essentially it would be necessary to define strict sustainability criteria in advance, such as methodologies to identify "zero deforestation" production areas, the reduction of chemical inputs and pesticides, the fair remuneration of farmers—and then estimate the volume of global production that meets these criteria, as well as the resulting overall cocoa price. Reversing this logic would increase the bargaining power of the most virtuous producers, thus giving them more autonomy, and ultimately guaranteeing better incomes. But this is all conditional on the adoption of precise sustainability definitions, whether from a social or environmental perspective. It therefore remains necessary, more so than ever, to clarify the notion of agroforestry and to adopt definitions of the forest that are compatible with the genuine conservation of natural ecosystems.

Finally, the regulatory intervention of states, both producers or importers, is vitally important. With competition currently working against sustainability, the harmonisation of environmental standards in terms of trade and production is essential to avoid discouraging the sector's most virtuous actors.

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Agricultural value chains facing the biodiversity challenge: the cocoa-chocolate example

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