Stakeholder Collaboration in Climate-Smart Agricultural Production Innovations: Insights from the Cocoa Industry in Ghana

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Abstract

Although collaboration is vital in addressing global environmental sustainability challenges, research understanding on stakeholder engagement in climate-smart production innovation adoption and implementation, remains limited. In this paper, we advance knowledge about stakeholder collaboration by examining the roles played by stakeholders in scaling up ecological sustainability innovations. Using the illustrative context and case of green cocoa industry in Ghana, the analysis identified three distinctive phases of stakeholder engagement in ecological sustainability innovations implemented from 1960-2017. We highlight defining periods of ecological challenges encompassing the production recovery sustainability initiative phase solely driven by the Ghana Cocoa Board (COCOBOD)–a governmental body responsible for production, processing and marketing of cocoa, coffee and sheanut. During the period, major initiatives were driven by non-governmental organisations in collaboration with COCOBOD to implement the Climate-Smart agriculture scheme in the cocoa sector. The findings have implications for cocoa production research and stakeholder collaboration in environmental innovations adoption.

Keywords: Stakeholder collaboration, Environmental innovation, Ecological sustainability, Historical pathways, Scaling up, Cocoa industry

1. INTRODUCTION

In this era of increasingly environmental awareness, organizations and governments are increasingly recognising that reducing environmental degradations, waste and reversing deforestation require collaboration not only among businesses and governments but also including non-governmental organisations (Green et al. 2012; Rondinelli and London 2003). As the global population continue to surge, increasingly pressures are also being exerted on production and natural resource exploitations (Asongu and Jingwa 2012). Past studies suggest that creating green national economies and green industries to promote sustainability is essential (Amankwah-Amoah and Sarpong 2016; Asongu and Jingwa 2012). Thus, ecological sustainability improvement remains a major strategic imperative for industries and government alike. In the global cocoa commodity chains and networks, this is no different (Bitzer et al. 2012; Ton et al. 2008). However, the current literature lacks any insights on how governments and other stakeholder collaboratively initiative a shift towards "green" in industrial sectors. Indeed, there is dearth of understanding of the state of the art as far as stakeholder collaboration in environmental innovation towards a green cocoa industry (CI) is concern.

Although there are myriad of ecological initiatives introduced by both public and private sector actors at different levels (Glin et al. 2015), many have not had the needed impact as unsustainable practices persists in the industry (Blaser et al. 2017). The inability to reverse the prevailing ecological decline (soil fertility depletion and soil quality degradation – see Tondoh et al. 2015) amidst the introduction of numerous ecological innovations (climate-smart agroforestry initiative on the use of shade trees and compost – Ingram et al., 2018) raises questions about ecological innovation implementation challenge, particularly stakeholder involvement.

Despite the potentially pivotal role of value added and stakeholder collaboration (SC) in ecological sustainability programmes (Deans et al. 2018; Sarkis and Zhu 2018), there is limited research

54 understanding on the state of the art, for example, a historical evolution of ecological sustainability
55 programmes implemented. Against this backdrop, the aim of this study, the first of its kind, is to
56 critically evaluate and interpret existing knowledge embedded along periods of ecological evolution
57 challenges and the role of stakeholders in ecological innovation adoption and implementation. We
58 contend that the co-creation of the capabilities of CI stakeholders is critical for the implementation
59 of ecological innovations to address the huge and complex sustainability challenge. Our analysis
60 covered the period from the late 1960s—2017; a defining period in the CI in Ghana as far as
61 ecological challenges are concern.

62

63 Our choice of the CI in Ghana as an exemplar setting for this study is based on several factors.
64 The study focusses on the CI because the bulk of the world's cocoa (69.7 %) is cultivated in the
65 tropics of West Africa, with Ghana considered a large player in the world market (Aboah et al.
66 2019) given that it is the second largest producer and exporter of cocoa beans after the Ivory Coast
67 (Verter 2016). Cocoa is considered as the backbone of the Ghanaian economy, serving as a key
68 source of foreign exchange and contributing about 13% to the country's gross domestic product
69 (Asubonteng et al. 2018). Although, cocoa contributes approximately 23% of total export earnings
70 of the country, its contribution to the agricultural Gross Domestic Product (GDP) has decreased
71 to 11% by 2013, from 34% contribution in 1964 (Boansi, 2013). Figure 1 shows recent export of
72 cocoa from Ghana to the top global markets (European Union, the United States and Asia)
73 between 2006 and 2016 (Bangmarigu and Qineti 2018). It can be seen that the cumulative export
74 of cocoa from Ghana has generally increased from 2010 levels.

75

76 **<<Insert Figure 1>>**

77

Despite the important role that the CI plays in poverty alleviation and economic advancement, in recent years, the cocoa sector has been confronted with the challenge of low yield. Cocoa production yield has either stagnated or declined in most of the cocoa growing regions in Ghana (Anim-Kwapong and Frimpong 2005; Baffoe-Asare et al. 2013). The Ghana Cocoa Board (COCOBOD)–the governmental body in charge of production, processing and marketing of cocoa, coffee and sheanut has been the main stakeholder at the helm of most of the decisions affecting the cocoa sector.

Drawing on the instrumental form of stakeholder theory; see Donaldson and Preston (1995) and advancing knowledge on SC (Amankwah-Amoah et al. 2019), we examine the roles played by cocoa sector stakeholders in scaling up ecological sustainability innovations. The historical analyses of the archival data revealed three distinctive phases of stakeholder engagement (SE) in ecological sustainability innovations implemented from 1960-2017. Further contribution is derived from the development of a historical pathway model of the process through which ecological innovations have evolved and implemented to facilitate the shift towards a green CI. In addition, the paper contributes to existing knowledge through its revealing account that: 1) the production recovery sustainability initiative phase from late 1960s–1982 was solely driven by one stakeholder, the COCOBOD 2) major initiatives during the cocoa sector recovery stage (1983–1990s) were initiated and implemented by non-governmental organisations (NGOS); 3) the third phase (sustainability initiative, revival and expansion era from 2000–late 2017) showed many NGOs collaborated with COCOBOD to implement the climate-smart agriculture scheme in the cocoa sector.

To achieve the research aim and specific objectives highlighted, the rest of this paper is organised as follows. We first review the literature on SC for effective scaling up of innovations. This is followed, in Section 3, by the description of the archival data. The next section 4 presents the

historical analyses of ecological sustainability challenges as well as SE in ecological sustainability innovation programmes in Ghana's CI. Section 5 provides discussion, contributions and research implications of the findings.

2.0 STAKEHOLDER COLLABORATION AND SUSTAINABILITY INITIATIVE

For context, the study adopts Freeman's definition of stakeholder for this paper - 'those groups and individuals who can affect or be affected' by the actions connected to value creation and trade (Freeman et al. 2010, p9). The stakeholder theory essentially enjoins stakeholders to cooperate for mutual benefits as they do not function in isolation (Freeman 2010; Savage et al. 2010). Notably, Goodman et al. (2017) suggests a dual collaborative and proactive roles of stakeholders and opined that secondary stakeholders may play a more prominent role in sustainability innovation adoption that primary stakeholders.

It is also important to draw on Donaldson and Preston (1995) to differentiate between the two forms of stakeholder theory–traditional versus contemporary stakeholder models and how they apply to the specific case of the CI in Ghana for which we seek to examine stakeholder collaboration. These adaptions are presented in Figure 2 and 3 respectively to reflect the traditional and emerging stakeholder models of the CI. It is also worth highlighting that stakeholder theory has been applied in some ecological, socio-economic and sustainable development research (Pullman and Wikoff 2017; Simpson and Sroufe 2014; Sodhi and Tang 2018).

<<Insert Figure 2>>

125

126 **<<Insert Figure 3>>**

127

128

129 The need for SC to ensure effective scaling-up of sustainability initiatives such as climate smart
130 agriculture scheme in the CI is driven by economic, social and environmental imperatives (Akrofi-
131 Atitianti et al. 2018; Amlalo and Oppong-Boadi 2015). SC is critical to the different levels of
132 decision making and governance systems with a typical agricultural production chain (Despoudi et
133 al. 2018; Wigboldus et al. 2017). Hence, the willingness and ability to identify the various ways in
134 which practices, systems, and their impacts are assessed by stakeholders is cardinal to the success
135 of innovation adoption and implementation. This is partly because any sustainability initiative is a
136 complex triple bottom that requires collective agreement and decision regarding its content
137 (Goodman et al. 2017) to enhance its chance of successful implementation. The value of SE within
138 a supply chain is to create value addition and this is well articulated in academic literature
139 (Genovese et al. 2013; Kannan 2017; Millard 2011; Nudurupati et al. 2015). The value accruing
140 from stakeholder engagement is attained through the myriad roles stakeholders play in
141 sustainability initiatives such as stimulator, initiator, broker/mediator, concept refiner, legitimator,
142 educator, context enabler and impact extender (Goodman et al. 2017). Attempts towards
143 addressing climate change and natural resource depletion issues has focussed research attention
144 on industry partners' collaboration towards environmental innovation for sustainability; see Perl-
145 Vorbach et al. (2014) and Dangelico (2016). However, harnessing stakeholders' interests,
146 relationships and unique roles to promote scaling up ecological innovations in the CI remains a
147 huge research challenge (Cramer 1999; Gibbon 2004; Talbot 2002).

148

149 **2.1 Scaling-up and Sustainability Initiatives**

150 The central plank of scaling-up is to ensure effective dissemination of best practices (ecological
151 innovation in the context of this study) that lead to efficient deployment of resources (Hartmann
152 and Linn 2008). Scaling-up thus involves 'expanding', 'adapting' and 'sustaining successful policies,
153 programmes or projects in different places and over time' for the benefit of many people
154 (Hartmann and Linn 2008) or end users (Jowett and Dyer 2012) or stakeholders (Hörisch et al.
155 2014). It is important to indicate that scaling up agriculture-related innovations ought to consider
156 the complex interactions between all biophysical, socio-economic and institutional issues,
157 including SC (Leeuwis 2000; Wigboldus et al. 2017).

158 Thus, scaling-up sustainability initiatives within the CI in Ghana can be fostered through inclusive
159 wider stakeholder partnership consisting of public-private-civil society-producer-research
160 engagement (Ingram et al. 2018). Such a widened societal approach as opposed to the traditional
161 public-private collaboration will facilitate expanding, adapting and sustaining successful
162 sustainability policies, programmes or projects such as: complete replanting of old cocoa fields
163 (Wessel and Quist-Wessel 2015); the use of improved planting materials (Edwin and Masters
164 2005); Voluntary certification of sustainability standards (Ingram et al. 2018), among others.
165 Overall, there is a growing recognition that scaling-up of sustainability initiatives within the CI will
166 succeed when initiatives foster continuous improvement and the farmer stakeholder is convinced
167 of the (re)investment value of the sector with minimal external support (Molenaar et al. 2015;
168 Wessel and Quist-Wessel 2015). Therefore, the need for inclusive stakeholder participation in
169 scaling up ecological innovations cannot be overemphasised.

170 Drawing on the conceptual framework of Hörisch et al. (2014), that was developed for increased
171 applicability of stakeholder theory in sustainability management, we develop an integrated
172 framework of SE in facilitating scaling-up of ecological innovations in the CI. We contend that

173 the CI's ecological sustainability priorities entail both accessing superior ecological innovation
174 intervention and effective SE for a sustainable CI, as summarised in Figure 4.

175

176 **<<Insert Figure 4>>**

177 Although the ecological impact of cocoa production has encouraged scholars to delve into the CI's
178 greening policies, limited attention has been given to the evolution of the scaling-up process via
179 SC. Indeed, limited success at scaling up of ecological innovations has hampered the industry's
180 attempts at improving its sustainability credentials. It has rendered it susceptible to low yields and
181 the prospect of the industry is threatened by unsustainable production practices. Based on the
182 above premise, the study draws on historical trends to improve our understanding of the state of
183 ecological innovations in the Ghanaian CI from a stakeholder perspective.

184

185 **3.0 RESEARCH SETTING**

186 The CI has been the mainstay of the Ghanaian economy for many decades. It is presently the
187 second largest producer of cocoa in the world after Côte d'Ivoire and close to 6.3 million
188 Ghanaians depend on the cocoa sector as source of livelihood. Since the first export of cocoa
189 beans (40,000 tonnes) in 1911(Austin, 2014), the industry has experienced fluctuation in export
190 value, yield and prices as shown in Figure 5. The trends depicted in Figure 5 suggest the basic
191 economic principle of demand and supply determining price has not always applied to cocoa
192 pricing over the period.

193 **<<Insert Figure 5>>**

194 It is also important to highlight that increases in cocoa area of production has not always resulted
195 in a proportionate increase in volume of cocoa beans produced (Boansi, 2013), as presented in
196 Figure 6 covering the period 1961 – 2011.

<<Insert Figure 6>>

Another important industry indicator is the producer price (price that cocoa farmers receive) yearly which is a percentage of the world export value to Ghana's COCOBOD. Figure 7 indicate that generally world price of cocoa directly influence the producer price paid to farmers. Although, there have been periods such as 1981-83 when increasing world prices of cocoa rather corresponded to reducing producer prices.

<<Insert Figure 7>>

Further, the industry is saddled with ecological challenges that has spurred some number of initiatives over the past 5 decades. There has been a significant effort to tackle ecological challenges associated with the industry to make cocoa production more sustainable. The persistent characteristic unsustainable practices however points to meagre success of these initiatives. A constant feature across all implementation reports on these ecological sustainability programmes is the limited or lack of effective SC among other reasons.

The production recovery sustainability initiative stage of the late 1960s-1982 showed failure of government action at mass spraying without any other SE. Indeed, farmers as key stakeholders were not involved in the design and implementation plan. The same period witnessed the government of Ghana's unsuccessful attempt to curd smuggling of cocoa beans to neighbouring countries because farmers were not engaged in the planning process. Despite the increased cocoa producer prices by 30 percent, farmers could not reconcile the government's support for cocoa production with the unwillingness or inability of the same government to provide the conditions for the continued growth of this important commodity because of the lack of subsidy to support

replanting and spraying campaigns. Indeed, Gockowskei (2012) confirmed that there was no subsidy to Ghanaian cocoa farmers before the year 2000.

The appreciable success recorded during the cocoa sector's steady recovering stage (1983-late 1990s) also witnessed collaboration among non-governmental organizations (NGOs) in Ghana who focused on cocoa sustainability initiatives, example, Fairtrade International, the Kuapa Kokoo Farmers Union, UTZ certified and Rainforest alliance. This was the period of the Economic Recovery Programme (ERP) which included a special programme to revive the CI (the Cocoa Rehabilitation Project), the Cocoa Sector Development Strategy (CSDS) and the liberalization of the internal marketing of cocoa and increase in the producer price. Thus, a connection can be inferred between SC and ecological sustainability initiatives. The relatively improved level of SC that accompanied the implementation of a Climate-Smart Agriculture (CSA) scheme in the cocoa sector to drive sustainability goals within the CI within phase three further give credence to the critical role of SE. It is important to underscore that lack of consultation with farmers' impeded effective implementation of adaptation techniques.

The average cocoa yields in Ghana is 450 kg ha^{-1} compared to countries such as Ivory Coast, Indonesia and Malaysia which produces 800 kg, 1000 kg and 1800 kg per hectare respectively (Baffoe-Asare et al. 2013; Gockowski and Sonwa 2011). The relatively low yield record has been attributed to ecological challenges such as land degradation (Blaser et al. 2017) resulting from unsustainable farming practices like shifting cultivation in Ghana (Kusimi 2008). In addition, Gockowski and Sonwa (2011) confirmed that past increased cocoa yield was mainly due to increased land area committed to cocoa production. This production practice is a major contributor to deforestation in Ghana (Gockowski and Sonwa 2011).

In terms of the environment, Ghana's forest cover has significantly dwindled but cocoa growing areas are still planting cocoa trees in forest areas to ensure continuous cocoa production to meet

national targets and keep cocoa farmers in business. This situation is likely to persist as cocoa is a major foreign exchange earner for the country and global demand for chocolate and other cocoa products continue to increase (Nieburg 2014). The urgent need for effective implementation of ecologically sustainable innovations to promote higher yield per hectare (Wessel and Quist-Wessel 2015) is further amplified by the high demand and limited virgin forest for continuous cocoa production dilemma.

Regarding stakeholder participatory approach in the industry, COCOBOD has been the main stakeholder making most of the decisions affecting the cocoa sector for many decades. COCOBOD controls many parts of the cocoa supply chain; they set prices, control the quality, tests and distribute inputs, undertake research and provide extension services. It is also involved in buying and processing part of the cocoa beans. The board is also the sole exporter of cocoa beans from Ghana. Per its remit, the COCOBOD appears to prioritise achieving production targets and offering favourable producer prices to incentivize cocoa farmers (Laven and Boomsma 2012) over seeking SC for a sustainable cocoa production. Meanwhile, the global multi-stakeholder conference on 'Sustainable Cocoa' that took place in Panama in April 1998 ended in a consensus statement that sustainable production of cocoa will 'use constructive partnerships that are developed to involve all stakeholders with special emphasis on small-scale farmers' (Shapiro and Rosenquist 2004). But this does not appear to have had a practical expression in the case of ecological sustainability programmes of Ghana's CI.

There is an increasing recognition that the adoption of effective ecological innovations is not only essential in addressing the debilitating ecological challenges but also to provide the foundation towards achieving the long-term survival of the CI (Asante and Amuakwa-Mensah 2015; Asare et al. 2017; Krauss 2016; Somarriba and López Sampson 2018). This is critical to guarantee the livelihoods of the numerous producers, provide the vital foreign exchange for the country and ensure the continuous existence of the many large multinational companies that rely on the CI.

Ecological innovations such as organic cocoa production, Fairtrade policies, certification of cocoa produced under shade trees, carbon credit and good agronomic practices have been introduced to cocoa farmers by both public (COCOBOD) and private sector stakeholders at different levels of the production process to make the cocoa production more sustainable (Glin et al. 2015; Krauss 2016). However, these policies and ecological innovations have not had the needed impact at the farmers' level, since lands are still degraded (Blaser et al. 2017), and multipurpose shade trees are being cut down and cocoa is still grown under full-sun (UNDP 2011); a practice that is not sustainable (Glin et al. 2015).

3.1 Research Method

The study employed archival data consisting of expert reports, production records, COCOBOD and government policy documents (Amankwah-Amoah and Sarpong 2016), published expert interviews and policy feedback literature with relevant CI stakeholders, to identify key stakeholders and their respective roles in ecological sustainability innovations programme design and implementation. Besides examining government and relevant stakeholders' policy documents, we also examined other secondary sources. To identify the relevant archival data, we employed key words in combination such as farmers, stakeholders, stakeholder collaborations, stakeholder engagement, Ghana Cocoa Board, COCOBOD and cocoa traders. Using these keywords to search databases such as Clarivate Analytics and EBSCO, and Ghanaweb (https://www.ghanaweb.com/) identity and trace reports and articulate helped expanding the scope of our search. After identifying articles and documents, the authors examined the content to determine inclusion and exclusion (i.e. data must focus on stakeholder collaborations towards achieving sustainability in the CI). The analysis for the study commences from the late 1960s when the cocoa sector faced an outbreak of the three killer diseases (cocoa swollen shoot virus, black pod disease and capsid damage), which led to a significant decline in production with its attendant ecological problems. Archival data

sourced from the Ministry of Food and Agriculture and Finance, Ghana COCOBOD and the Ecobank Group is also analysed to delineate defining periods in the history of the industry as far as ecological challenges that faced the cocoa sector between the late 1960 and 2017 is concern to identify significant phases in the evolution of SE in ecological sustainability innovations implementation.

4.0 RESEARCH FINDINGS

4.1 Environmental Sustainability Challenges

The archival documents reviewed and analysed uncovered two dimensions within two broad periods of close to five decades of cocoa sector production strategy and stakeholder involvement evaluations. Both dimensions were characterized by distinctive phases of cocoa production policy and strategy, notable ecological sustainability challenges and SE in ecological sustainability innovations implementation over the period (1960s–2017). The two identified dimensions straddle across three strategic phases of cocoa production, namely production recovery, the steady recovery and expansion stages as presented in Table 1.

(Insert Table 1)

4.2 Dimension One: Historical Pathways to a Green CI in Ghana

Dimension one of the historical pathways to a green CI encapsulates a shift of thoughts in cocoa production policy and strategy, notable causes of ecological challenges and their manifestations, types and levels of stakeholder involvement in ecological innovations gleaned from late 1960s and late 1990s. The two main cocoa production policy and strategies uncovered under dimension one were the production recovery stage of late 1960 to 1982 and the steady recovery stage between 1983 and 1999. Each production policy and strategy adopted coincided with a particular ecological

challenge and manifestation that distinctive stakeholder(s) attempted to tackle. Major cocoa diseases outbreaks and forest land for expanded production were the main causes of ecological challenges captured within the framework of dimension one. In terms of ecological sustainability initiatives undertaken to combat diseases and deforestation within the scope of dimension one, two major initiatives planned and executed by a single stakeholder - the government of Ghana. The focus of this dual sustainability initiative was to achieve a quick recovery of yields lost to the three major disease outbreaks in the late 1960s. The first initiative was the mass spraying campaigns of cocoa farms. This was in response to the outbreak of cocoa swollen shoot virus, black pod disease and capsid damage which accounted for an estimated loss of 50,000 to 75,000 tonnes of cocoa each year. Production later dipped further to 159,000 tons in 1982/83. Having suffered about two decades of low yield in cocoa production from the late 1960s to the early 1980s, the then government introduced two free mass spraying of cocoa farms to reinvigorate the sector as part of the World Bank-supported Economic Recovery Programme (Nyanteng 1980).

Although the government reported the campaign was successful with the claim that the spread of diseases had been brought under control (Addo et al. 1979), it did not improve yields as expected (Oluyole and Lawal 2008) and it was subsequently terminated in the proceeding cocoa season. The reasons for the failure were inadequate supply of insecticides and spraying machines for effective spraying of all cocoa farms and lack of involvement of key stakeholders like farmers who ended up spending huge amounts of money to buy and apply chemicals which were supposed to be free by government agencies (Oluyole and Lawal 2008). The second initiative was the increase of cocoa producer prices and payment of bonuses to farmers.

After the major decline, the government of Ghana increased the cocoa producer prices by 30 percent and farmers were paid bonuses for top grade cocoa beans production (Kolavalli and Vigneri 2011). This initiative was a direct response to the smuggling of cocoa beans to

neighbouring countries (Ivory Coast and Togo) due to the low in-country prices during the late 1960s to early 1970. However, the consistent low yield neither provided farmers adequate income nor a better prospect for an appreciable future revenue for their livelihoods and care for their trees or gather the pods (Leiter and Harding 2004). Hence, despite the increased producer price initiative, tens of thousands of tons of Ghana's cocoa were smuggled annually to neighbouring Ivory Coast by the end of the 1970s to early 1980s (BulÌř 2002; Jacobeit 1991). Moreover, the increased producer prices were inconsistent with government's lack of subsidy for replanting and spraying campaigns. As a result, it was difficult to reconcile the government's support for cocoa production with the unwillingness or inability of the same government to provide the conditions for the continued growth of this important commodity (BulÌř 2002; Leiter and Harding 2004).

The failure of these major programmes during the production recovery initiative stage (late 1960s-1982) meant an escalation of the negative ecological effects due to increased use of pesticides as well as an increased demand for land to boast cocoa production than would otherwise be required. It is evident that the two major initiates during this period (late 1960s-1982) were driven mainly by one stakeholder, the government of Ghana through COCOBOD. Surprisingly, all other key stakeholders including farmers were not engaged in the entire process as the government solely initiated and managed the two programmes; mass spraying campaign of cocoa farms and increased cocoa producer prices by 30 percent plus bonuses for farmers that produced top grade cocoa beans (Nyanteng 1980).

The second ecological sustainability initiative was undertaking during the cocoa sector's steady recovering stage (1983-late 1990s). Ghana's cocoa production levels during this period (1983-late 1990s) increased gradually to an average yield of 400,000 metric tonnes per year (Abekoe et al. 2002) compared to the 159,000 tonnes in 1982. However, it was still considerably lower than the production levels attained in the mid-1960s. Three major initiatives accounted for this gradual

372 recovering. The first initiative was the Economic Recovery Programme (ERP) in 1983 which
373 included a special programme to revive the CI (the Cocoa Rehabilitation Project). The Cocoa
374 Sector Rehabilitation Project included reviewing the architecture and operations of COCOBOD
375 (the Government agency responsible for cocoa production) by restructuring and re-organising
376 some of its subsidiaries for efficiency - staff numbers were reduced to around 10,400 by 1995 and
377 then to 5,140 (Williams 2009). This reduction in staff numbers of almost 95% freed up
378 considerable resources and this was one of the primary contributing factors to the price increases
379 that ushered in the sector's regeneration (Fosu and Aryeetey 2008).

380 Policy changes included increasing the farm gate prices paid to Ghanaian farmers relative to those
381 paid in neighbouring countries, thus minimizing the incentive to smuggle, and devaluing the
382 Ghanaian currency (Cedi), and as a result reducing the level of implicit taxation of farmers
383 (Kolavalli and Vigneri 2011). As part of the Cocoa Rehabilitation Project, improved high-yielding
384 hybrid varieties were introduced in 1984 for adoption by farmers (Kolavalli and Vigneri 2011). The
385 farmers were also compensated for removing trees infected with swollen shoot virus and planting
386 the hybrid varieties (Kolavalli and Vigneri 2011).

387 This effort led to substantial rehabilitation, with many farmers planting the improved hybrid
388 varieties developed by the Cocoa Research Institute of Ghana (Bloomfield and Lass 1992; Boahene
389 et al. 1999). The World Bank and the Government of Ghana were the main stakeholders involved
390 in the planning and implementation of this project with the farmer as a passive beneficiary. The
391 second initiative was the Cocoa Sector Development Strategy (CSDS) in 1991 which was to help
392 boost cocoa production (Cobbina 2015). Under the strategy, cocoa production was projected to
393 increase from 335,000 tonnes in 1991 to about 500,000 tonnes by 2004/2005 and then to 700,000
394 tonnes by 2009/2010 (Cobbina 2015; Dormon 2006). As part of the reforms, in 1992 COCOBOD
395 shifted responsibility for domestic cocoa procurement to six privately licensed companies

(commonly known as licensed buying companies or LBCs). However, the Produce Buying Company (state-owned enterprise and a subsidiary of the COCOBOD) is still the leading buyer of cocoa beans although its market share was limited to about 68% as of 1997/1998.

The third initiative was in 1999 when the government of Ghana adopted a development strategy with the objective of improving the performance of the cocoa sector. Under this strategy, production levels were expected to reach 700,000 Mt by the year 2010. The resulting reforms led to the liberalization of the internal marketing of cocoa and increase in the producer price from 56% to 70% of the fob ('free on board') price over the period 1998/1999– 2004/2005 (Dormon 2006). The fob price is the price at which government sells cocoa to foreign buyers and includes, apart from a profit margin, all costs incurred in buying and transporting the beans to the port. The cocoa sector development strategy also involved shifting responsibility for cocoa extension services from the Cocoa Services Division, a subsidiary of the COCOBOD to the Ministry of Food and Agriculture (Dormon 2006). This period also marked the emergence of many non-governmental organizations (NGOs) in Ghana who focused on cocoa sustainability initiatives, example, Fairtrade International, the Kuapa Kokoo Farmers Union, UTZ certified and Rainforest alliance (Laven and Boomsma 2012).

4.3 Dimension Two: Historical Pathways to a Green CI

Dimension two of the historical pathways to a green CI was characterised by a major shift of thoughts in cocoa production policy and strategy from recovery to expansionist focus; accompanied with ecological challenges due to a) the introduction of high yielding varieties, b) unconstrained small scale mining and cocoa–rubber plantation substitution. Dimension two is also characterised by a multiple SC for ecological innovations from 2000 to late 2017. Indeed, the steady growth in cocoa production and yield became obvious from the early 2000s. A combination of a record-high world prices, increased producer price to farmers and a set of interventions rolled out

421 by the COCOBOD to improve farming practices accounted for the steady growth in production
422 and yield (Vigneri and Santos 2009). The implementation of three distinct but complementary
423 initiatives contributed immensely to the revival of the cocoa sector during over the past one and
424 half decades. The first initiative was the Government of Ghana mass-spray of all cocoa farms.
425 Since 2001 the government has mass-sprayed all cocoa farms under the nationwide Cocoa Disease
426 and Pest Control Project (CODAPEC) (Dormon et al. 2004). Under this programme, cocoa farms
427 across the country were sprayed with insecticides and fungicides at no cost to the farmers (Dormon
428 et al. 2004).
429 This exercise resulted in tremendous increases in cocoa production from 340,562 metric tons in
430 the 2001/02 season to 496,846 metric tons in 2002/03 and 736,000 metric tons in the 2003/04
431 seasons (Appiah 2004). However, along with the positive effects of the CODAPEC programme,
432 some negative impacts on the environment have also occurred. For instance, the extensive and
433 intensive use of pesticides on the farms led to the destruction of part of the soil flora and fauna
434 through both physical and chemical deterioration (Ntiamoah and Afrane 2008).

435 The second initiative was the 'Cocoa High-Tech' programme. In 2002/03, the COCOBOD rolled
436 out the 'Cocoa High-Tech' programme which was managed jointly by the Cocoa Research Institute
437 of Ghana (CRIG), COCOBOD and the Ministry of Food and Agriculture-MoFA (Dormon et al.
438 2004). Under this programme, the Government supplied fertilizers on credit at subsidies prices to
439 farmers to encourage them to apply a minimum of 5 bags per hectare (Kolavalli and Vigneri 2011).
440 In addition, there was an increased supply of pesticides to farmers and the provision of 60 million
441 high yielding hybrid seedlings per year for replanting of over-aged plantations and for
442 establishment of new farms (Vigneri and Santos 2009). Thus, this period marked the beginning of
443 Government subsidies that has since increased by an average of US$344 million as at 2010 and
444 2011 (Vigneri and Kolavalli, 2018). In its first year, 50,000 farmers benefited from the programme,
445 a number that increased to 100,000 one year later.

In 2003, its first year of testing, the package raised yields from 510 to 1,081 kilogrammes per hectare and to 2,317 kilogrammes per hectare after the third year (Dormon et al. 2004). In 2006 the Cocoa Abrabopa Association (CAA) was established, under which groups of farmers with mature trees on at least one hectare of land were given the inputs package on credit and offered technical and business training (Opoku-Ameyaw et al. 2012). However, because of inadequate engagement of major stakeholders in the cocoa sector, as this was mainly driven by the Government of Ghana through COCOBOD, a substantial proportion of farmers, nearly 40 percent, dropped out of the programme, so the benefits of the CAA package reached only a small share of cocoa growers; the programme finally collapsed without making the needed impact (Opoku-Ameyaw et al. 2012).

The third initiative during this period was the implementation of a Climate-Smart Agriculture (CSA) in the cocoa sector (Amlalo and Oppong-Boadi 2015) to drive sustainability goals within the industry post 2016 (Asare 2014; Hutchins et al. 2015). Akrofi-Atitianti et al. (2018) cites the Food and Agriculture Organisation's to the effect that CSA combines the triple bottom line of economic, social and environmental dimensions of sustainable development to 'build on three main pillars as follows: (1) sustainably increasing agricultural productivity and incomes; (2) adapting and building resilience to climate change and; (3) reducing and/or removing greenhouse gases emissions relative to conventional practices'. Integral to CSA objectives is to enable organisations develop carbon offset projects and attract carbon finance into forest and farming communities (Kragt et al. 2016). Prior to the implementation of CSA, a Climate-Smart Cocoa Working Group (CSCWG) had earlier been formed to address issues of sustainability within the sector and to explore the potential for carbon finance or climate mitigation benefits in February 2011 under the auspices of the Rockefeller Foundation, the Nature Conservation Research Centre (NCRC) and Forest Trends.

Despite the strong focus of this World Bank-led CSA programme to Reduce Emission from Deforestation and Forest degradation (REDD+) on the cocoa sector, Aneani et al. (2012) reported that greater percentage cocoa farmers still employed traditional unsustainable methods of production. It is instructive to report that although the programme has the backing of major players it does appear to struggle because of the limited insight into the inhibiting factors for the effective implementation of adaptation techniques by farmers (Antwi-Agyei et al. 2013)–another typical case of minimal or limited key SC and engagement.

In a nutshell, Ghana's cocoa sector has been saddled with ecological issues from its embryonic stage as a thriving industry and a key foreign exchange earner for the country. In retrospect, the prevalence of ecological challenges associated with the CI in the 21st century (Gockowski and Sonwa 2011) gives an indication that the ecological problems have persisted but expressed in different forms and at varied levels of severity throughout the history of the industry.

Rapid expansion of extensive cocoa production systems in the last 20 years is a major cause of deforestation and forest degradation in West Africa (Gockowski and Sonwa 2011; Obiri et al. 2007). It is therefore not surprising that concerns over the ecological impact of cocoa farming and its sustainability is a pressing issue requiring urgent attention (Asare et al. 2017; Graefe et al. 2017; Krauss 2016; Owusu-Amankwah 2015). Based on the above findings we contend that the CI's ecological sustainability priorities entail both accessing superior ecological innovation intervention and effective SE for a sustainable CI, as summarised in Figure 4.

5. DISCUSSION AND CONTRIBUTIONS AND IMPLICATIONS

5.1 Discussions

This paper set out to investigate the historical pathways of the roles played by stakeholders in scaling up ecological sustainability innovations. By interrogating the archival data, we identified

four defining periods of ecological challenges in the history of the CI as well as three distinctive phases of SE in ecological sustainability innovations implemented from 1960-2017. We examined the evolutionary pathways to a green CI against the background of a prevailing ecological decline amidst the introduction of several ecological innovations between 1960–2017. Of special interest is the role of industry stakeholders in ecological innovation implementation as the state has led many of the initiatives including the flagship organic cocoa network.

The four ecological sustainability challenges in Ghana's CI for the period considered identified were: 1) the major disease outbreak era - late 1960s to early 1970, 2) forest land expansionist production strategy era - 1970s–late 1990s, 3) high yielding hybrid varieties introduction era - early 2000s–late 2010 and the 4) unrestrained small scale illegal mining (´Galamsey`) and rubber plantations for cocoa farms era - Post 2010–late 2017. Key highlights during the major disease outbreak era include farmers shifting from cocoa production to other crops, some deliberately cutting down and destroying cocoa farms to make the land available for alternative use; adopting simple technologies and clearing virgin forest for new farms. The net effect of the major disease outbreak within this phase lower yield of cocoa in Ghana due to low inputs use, planting of low yielding local varieties and farmers inability to control important pests and diseases outbreak.

The next phase of forest land expansionist production strategy era (1970s–Late 1990s) was characterised by massive deforestation as the major disease's outbreaks were not properly resolved. Farmers found it more economical to expand their farms rather than to replace old and diseased trees. This period could be described as the epoch of ecological damage to forests in the country for cocoa cultivation. It was not surprising that the next challenge was to improve cocoa yields within the constraint of less or no more fertile forest lands for cultivation.

The next phase was the era of the introduction of high yielding hybrid varieties introduction era (early 2000s–Late 2010). This phase witnessed the introduction of 'Cocoa High-Tech' programme

519 designed to encourage farmers to plant high yielding hybrid varieties and to apply high inorganic
520 fertilizers that had implications for environmental damage. Thus, the ecological challenge was
521 rather pronounced on the back of high yielding variety introduction due to the side effects of
522 heavy inorganic fertilizer usage. The adoption of full sun for hybrid variety cultivation was another
523 event that contributed to land degradation and deforestation.
524 Phase four of the ecological challenge described as the unrestrained small-scale illegal mining
525 (´Galamsey`) and rubber plantations for cocoa farms era (post 2010 – Late 2017) has had the most
526 rapid devastating effect on the CI.

527 During this phase, some cocoa farmers have their farms encroached by illegal miners and in some
528 cases, due to immediate high financial returns, farmers have sold their cocoa farms to miners.

529 The three phases of the evolution of SE in ecological sustainability innovations implementation
530 have unique features and different outcomes. Phase one was an era that ecological sustainability
531 initiatives were mainly planned and executed by the central government via the COCOBOD. This
532 level of limited or no SC reflected in the meagre success or total failure of the various initiatives
533 during the period (1960s–1982). In fact, the lack of cooperation by farmers due to lack of
534 consultation rather heightened ecological challenges as disease outbreaks were not managed
535 properly (See, Joo et al. (2018) for a comparative case from Korea's manufacturing industry).
536 Hence, the need for intensive use of inorganic fertilizers in phase two to support the introduction
537 of hybrid seeds.

538 The cocoa sector steady recovering stage was also characterised by collaboration among non-
539 governmental organisations such as Fairtrade International, the Kuapa Kokoo Farmers Union and
540 UTZ certified and Rainforest alliance. SC during phase three involved more stakeholders from
541 public, non-governmental and International institutions. They included the COCOBOD, Ministry
542 of Food and Agriculture, Rockefeller Foundation, Nature Conservation Research Centre and

543 Forest trends. A working group was even set up towards the implementation of the third initiative
544 within this phase – the Climate Smart Cocoa Working group. Judging from the incremental success
545 achieved under these three distinctive phases and the corresponding increase in the yield of cocoa
546 beans, it can be argued the success or failure of ecological sustainability initiatives is directly related
547 to the extent of collaboration among stakeholders within the CI. It rather intriguing to report that
548 consent farmers are yet to be fully involved in the design of any ecological sustainability initiative.
549

550 **5.2 Research Contributions**

551 The results of the study contribute to the academic literature on stakeholder theory, scaling up and
552 ecological sustainability innovation literature. Firstly, the study is a novel attempt to connect
553 stakeholder theory and the scaling up of new ecological sustainability innovations towards
554 fostering the sustainable CI agenda. Existing studies such as Glin et al. (2015) and Owusu-
555 Amankwah (2015) have highlighted the lack of participation of stakeholders, especially farmers
556 but limited in terms of examining the role of shareholder collaboration in the design and
557 implementation of ecological sustainability innovations within the CI. To the best of our
558 knowledge no study in stakeholder theory and scaling-up of ecological sustainability innovations
559 have given thought to the influence of history and evolutionary pathways.

560 We enhance this strand of research by showing that historical events and variables shape ecological
561 sustainability innovation implementation outcomes. The study contributes to the literature on
562 sustainable CI by Nelson and Phillips (2018) by highlighting the how ecological sustainability
563 challenges has evolved and the historical pathways that innovations and initiatives has been
564 followed to embed sustainability into CI management and practices. The historical narrative
565 approach is in conformity with previous studies that recommended drawing on history to research
566 policy and initiatives (Amankwah-Amoah and Sarpong 2016; Jones and Khanna 2004).
567

5.3 Research Implications

The study further has implications for CI practices and ecological sustainability policy. The finding that the lack of stakeholder involvement compounded ecological problems is a classic case with industry practice implications. The CI players particularly the government of Ghana and COCOBOD ought to begin to involve all stakeholders, particularly farmers even in an emergency operation as lack of engagement is bound to aggravate ecological and diseases outbreaks challenges. The findings indicate SE play a critical role in the success or failure of ecological sustainability innovations. Thus, effort need to be made to involve all consent stakeholders for every ecological sustainability innovation initiated from the design phase through its implementation and control stages.

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Code availability (software application or custom code): Not applicable

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LIST OF FIGURES

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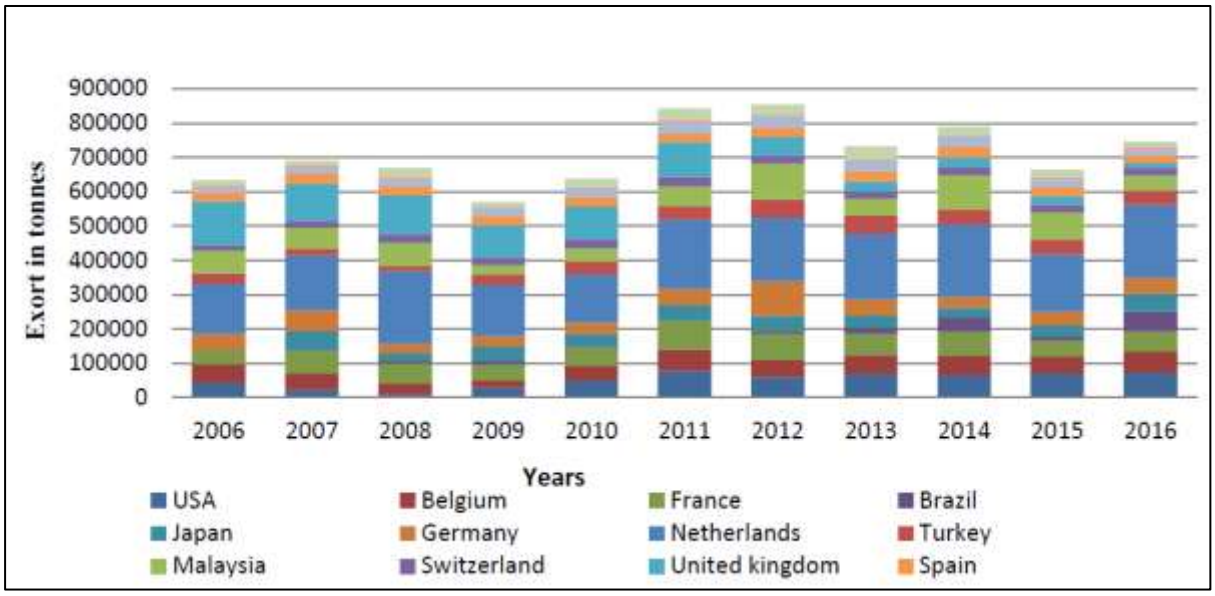

Figure 1: Export of cocoa from Ghana to top global markets (Bangmarigu and Qineti 2018)

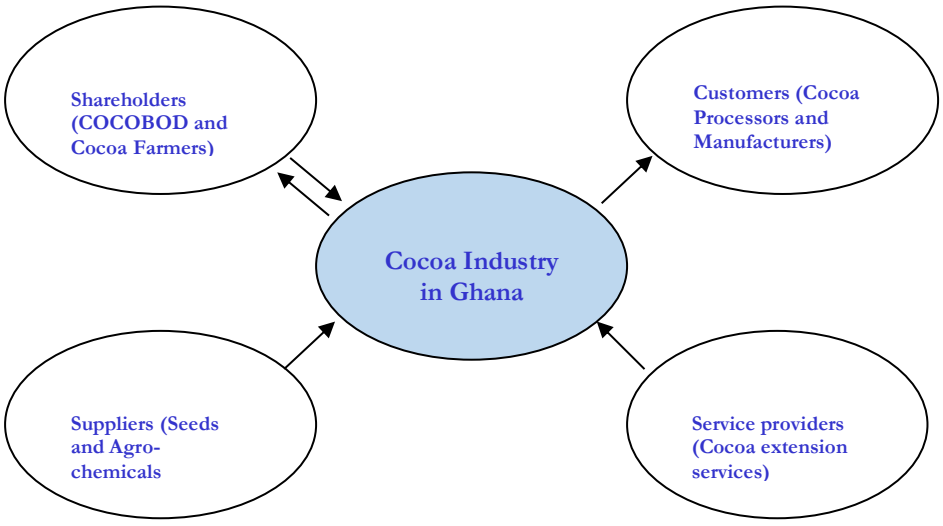

Figure 2: Traditional Cocoa Industry Stakeholder Model

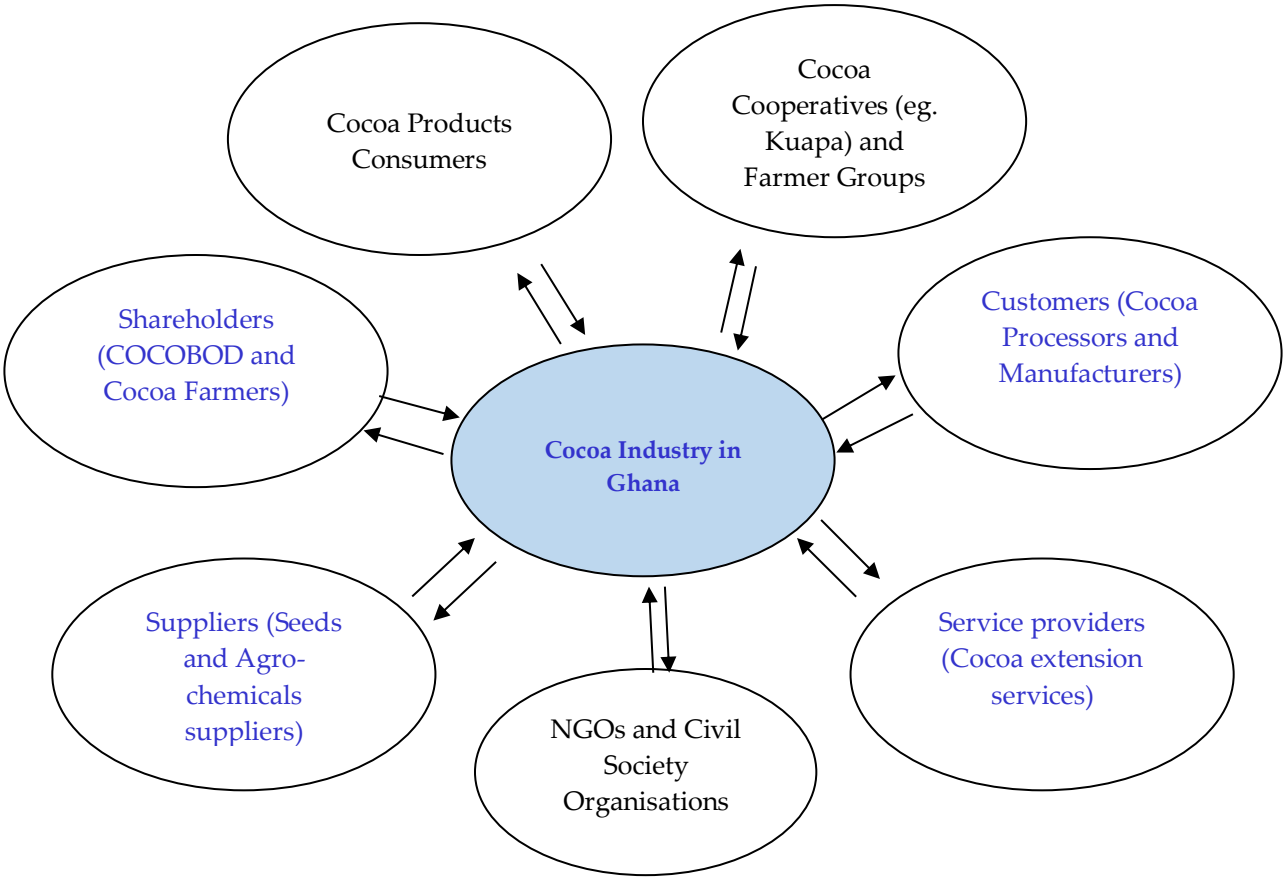

Figure 3: Emerging Cocoa Industry Stakeholder Model

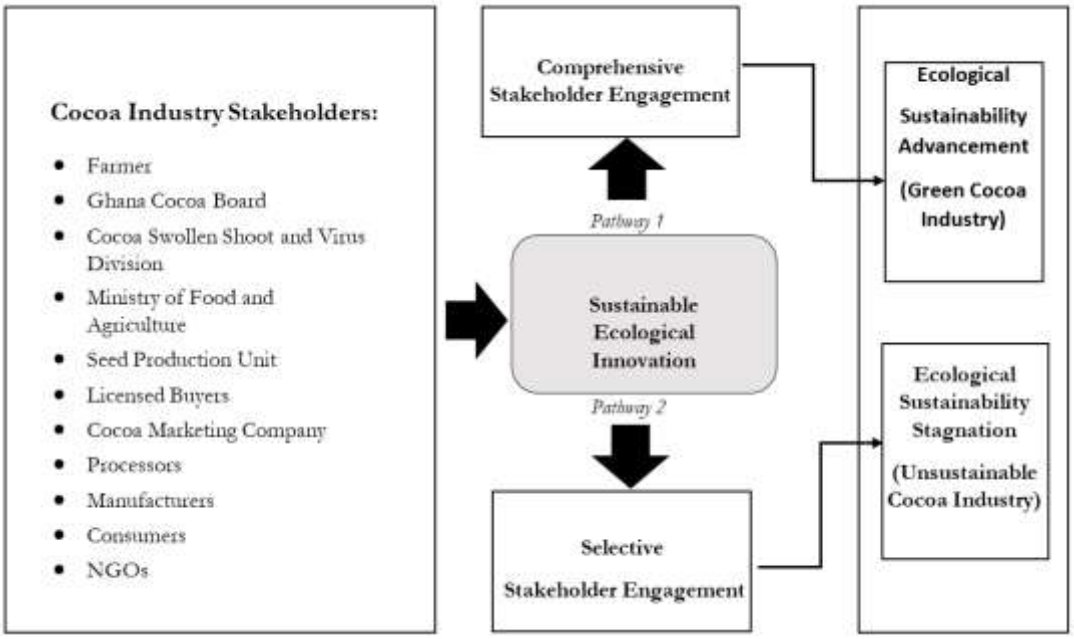

Figure 4: A framework for Cocoa industry SE in scaling up ecological innovation

Figure 5: Historical Overview of Cocoa World Prices and Ghana Production: 1947–2014 (Source: Vigneri and Klavali, 2018).

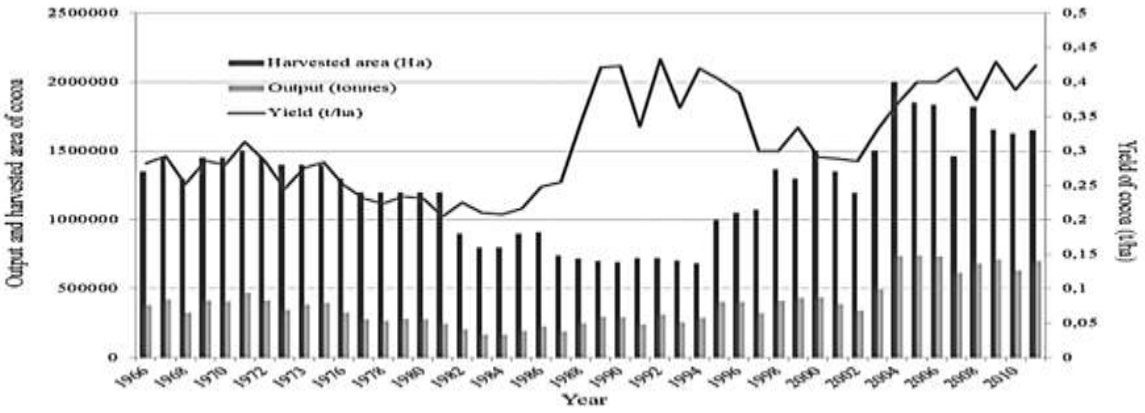

Figure 6: Trend in cocoa production, harvested area and yield 1961 - 2011 (Source: Boansi, 2013)

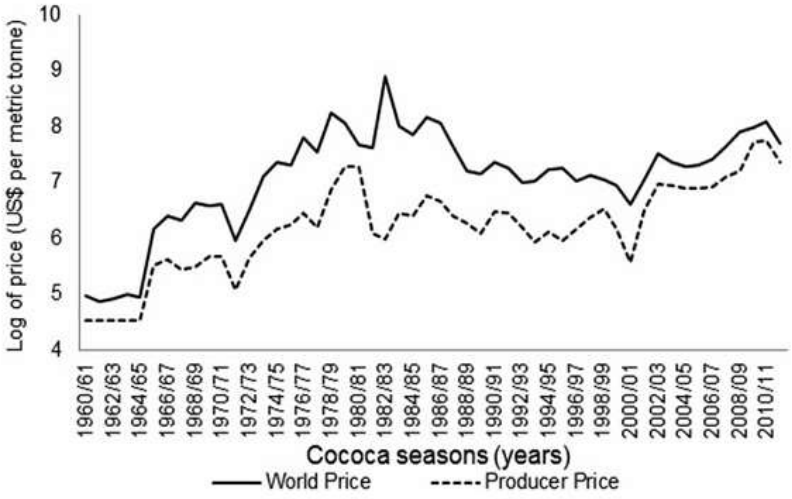

Figure 7: World and Producer Prices in US$ per metric tonne, 1960–2011 (Source: Quarmine et al., 2014)

859 **TABLE: Manuscript ID EMVM-D-20-00360 - EMVM**
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862 **Table 1: Cocoa Production Policy/Strategy, Ecological Challenges and SE - (Late 1960s – Late 2017)**

Phases of Production Policy and Strategy	Causes of Ecological Challenge and Manifestations	Type/Level of SC
Production recovery stage (Late 1960s – 1982) The steady recovery stage (1983 – Late 1999)	Major disease outbreaks – *(Pesticide misuse and residual effect on environment and destruction of cocoa farms).* Forest land expansion for cocoa production – *(Massive deforestation due to more land being committed to cultivation).*	Single stakeholder *(Government of Ghana – COCOBOD)* Multiple cocoa industry SE *(Non-governmental organizations: Fairtrade international, Kuapa Kokoo Farmers Union, UTZ certified and Rainforest alliance)*
Expansionist policy stage (2000 – Late 2017)	High yielding hybrid variety introduced with increased inorganic fertilizer usage – *(Intensive inorganic fertilizer usage and full sun practice led to soil fertility loss and land degradation).* Unrestrained small-scale mining and cocoa – rubber plantation substitution – *(Increased soil toxicity that affects cocoa beans quality, limited land for cultivation and disease control challenges).*	Multiple SC *(COCOBOD, Ministry of Food and Agriculture, Rockefeller Foundation, Nature Conservation Research Centre and Forest trends)*

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