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6 **Reconcilability of Socio-Economic Development** 7 **and Environmental Conservation in Sub-Saharan Africa**

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11

12 **Abstract**

13 Are the achievements of sustainable development and the improvement of environmental
14 standards mutually exclusive in the 21st century? Is there a possibility to combine the two?
15 This study is an effort to investigate the mutual exclusiveness of the two policy areas and
16 asks for the necessity and possibility to combine the two with a reference to Sub-Saharan
17 Africa (SSA). After describing the historical, geographical, and climatic backgrounds of
18 SSA, negative effects of global warming and local environmentally harmful practices are
19 discussed. Subsequently, the appropriate development measures for the region are
20 elaborated on in order to understand their compatibility with regards to improving the
21 environment. It is concluded that to change the dependency on agriculture, the economy
22 needs to be restructured towards technologies. Furthermore, it is found that there is a direct
23 link between global warming and economic efficiency. Theories, which imply that some
24 regions are simply ‘too poor to be green’, are investigated and rebutted by another theory,
25 which states that it is indeed possible to industrialize in an environmentally friendly way. It
26 follows that environmental and development measures are interconnected, equally
27 important and can be reconciled. The paper finally concludes that the threat posed by

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28 global warming and the previously practised environmentally-harmful local measures
29 might be so pressing that it might be too tragic to go for ‘develop first and clean up later’
30 approach.

31

32 **Keywords:** Climate change, global warming, pollution, sustainable development,
33 development measurements, environmental measurement.

34

35 **1. Introduction**

36 The region of SSA, is one of the poorest areas in the world due to, amongst other reasons,
37 economic mismanagement, post-colonial struggles, the spread of infectious diseases
38 (especially HIV/AIDS), inter-ethnic conflicts, desertification, and water shortages.
39 However, in the 21st century, global warming is also increasingly affecting SSA, as the
40 region, which is heavily reliant on the export of agricultural products, has more and more
41 been threatened by rising desertification. It is proven that there is a direct link between
42 global warming and poverty in SSA and that it will become even more difficult for the
43 region to increase economic growth and sustainable development in the future due to the
44 devastating effects of the climate change (UNEP, 2002, p. 29).

45 “Warmer temperatures and altered rainfall patterns could open up new areas to
46 diseases such as malaria, yellow fever, dengue fever and trypanosomiasis (IPCC,
47 1998)”.

48

49 Thus, measures combating climate change and local environmentally harmful practices
50 have become more important for sustainable development in SSA. In line with the
51 principle of equity for instance, the share of global emissions originating in the SSA
52 countries will need to grow in order to meet their social and development needs if,

53 according to the Kyoto Protocol (UNFCCC, 2008), the countries should share the common
54 responsibility of all countries in reducing emissions. This could mean that they are allowed
55 to increase both their productions and pollution. Consequently, for their agricultural system
56 for instance, farmers will continue their conventional farming systems that encourages the
57 use of chemical fertilizers and pesticides while they need to consider other (sustainable)
58 agricultural approaches (Azadi and Ho, 2010; Azadi et al., 2011a,b) based on their local
59 measurements (Bazuin et al., 2011) as well.

60 Accordingly, the question of the reconcilability of anti-global warming measures, local
61 environmental protection measures, and development policies arises. Earlier, literature
62 introduced the theory of Grossman and Krueger (1991) who applied the Environmental
63 Kuznets Curve (EKC) which implies that “low income regions are ‘too poor to be green’”.

64 According to the EKC, while high-income countries will naturally reduce pollution as they
65 become richer, low-income countries are neither capable of reducing pollution nor of
66 developing economically in an environmentally friendly way (Bertinelli et al., 2005, p. 2).

67 Unlike this theory, in this paper, a new premise will be investigated. The premise questions
68 a deduction from the EKC, asking whether pollution is directly connected to income.

69 Moreover, the question whether environmental measures that aim to challenge with the
70 problem of global climate change, remains on Sub-Saharan Africa’s responsibility, is

71 addressed. More precisely, the following thesis will be discussed. Investing resources into
72 environmental improvement would automatically mean that few resources will be invested

73 in socio-economic development. Thus, protecting the environment may retard the process
74 of developing in regions like SSA. Therefore, a focus on environmental protection is only

75 possible when the region is more developed. To investigate the thesis, the following
76 questions will be answered. Are the achievement of sustainable development and the

77 improvement of environmental standards mutually exclusive in the 21st century? Is there a
78 possibility to combine the two?

79 Before starting our main arguments, it should be mentioned that reconcilability has a lot
80 more to do with socio-economic development than the structural changes of economy,
81 incentives to invest in and the development of technologies, because the environmental
82 measures have more to do with the socio-economic development than simply stopping
83 (e.g.) deforestation and over-exploiting or switching in renewable energies and more
84 efficient technologies. However, a narrower scientific analysis in which only a few specific
85 development strategies are investigated as their ability to be transformed into more
86 environmentally friendly strategies would provide a more complex analysis of the issue.

87

88 **2. Reasons for and characteristics of Sub-Saharan Africa's underdevelopment**

89 While today, Sub-Saharan Africa contains the poorest countries of the World (50% of its
90 population live on less than a Dollar a day), (Canada International Development Agency,
91 2008), before colonialism, most societies resembled nation-states with tribes of the same
92 ethnicity living in self-sufficient communities independent from each other:

93 “...organized around kith and kin, with authority exercised through a system of
94 chieftaincy, clan elders, and heads of households. Given the mainly autarchic way
95 of life of most people, this was generally adequate to meet most welfare
96 requirements — from housing and the storage of food to personal support in times
97 of bereavement — based on accepted reciprocity and equitable personal intimacies”
98 (Osei-Hwedie and Bar-on, 2007).

99

100 The Colonial powers subjected cultural and all socio-economic and political activities to
101 their interests; Africans were to be physical workers. Thus, the Western type of education,

102 health, and related social services were restricted to “upper” classes of the population. In
103 other words, Colonialism is one of the reasons why countries in Africa became structurally
104 dependent on the Western Powers and did not develop at the same speed (Osei-Hwedie and
105 Bar-on, 2007). Dos Santos’ statement about the dependency-theory explains the situation
106 quite well:

107 “[Dependency is]...a historical condition which shapes a certain structure of the
108 world economy such that it favours some countries to the detriment of others and
109 limits the development possibilities of the subordinate economics...a situation in
110 which the economy of a certain group of countries is conditioned by the
111 development and expansion of another economy, to which their own is subjected.”
112 (Dos Santos, 1971, p. 2)

113

114 Largely colonized by Great Britain, France and Portugal, the states of Sub-Saharan Africa
115 slowly started regaining independence after the Second World War and the whole continent
116 was decolonized by 1980. However, the boundaries were drawn in 1884 by the state-officials
117 of the colonial powers regardless of cultural and ethnic groups or tribes.

118 “Africa’s boundaries were, for the most part, arrived at with no reference at all to
119 the social or cultural characteristics of the people they partitioned...An indication of
120 their disregard for the populations they bisect comes from Asiwaju’s (1985)
121 estimate that Africa’s 104 distinct borders divide 177 cultural or ethnic groups.”
122 (Posner, 2006, p. 2)

123

124 The arbitrariness of the “border-decisions” led to struggles connected to self-determination
125 and racial discriminative attitudes in the region. In some states of SSA, a complete collapse
126 of the state and subsequent collapse of institutions and socio-economic development

127 policies has occurred. Examples are Somalia or Congo where civil wars were caused by
128 ethnic conflicts (van de Walle and Ball, 2003, p. 1). However, even the politically most
129 stable countries of the region do not appear to be capable of implementing policies that aim
130 at enhancing the structural transformation of the economy. States are characterized by low
131 absorption capacity, fiscal crisis and corruption (UNIDO, 2004, p. 45). The whole region is
132 dependent on natural resources, high levels of poverty and weak infrastructure. As bluntly
133 stated by Michael Glanz:

134 “Sub-Saharan Africa is plagued by innumerable problems related to population
135 growth rates, resource depletion, environmental degradation, bleak food-
136 production prospects, heavy international debt, little or no foreign exchange
137 and an uncertain climate, not only the climate of the future (e.g. climate
138 change) but the climate of today (e.g. climate variability)” (Glanz, 1992).

139

140 The exogenous factors, which influence SSA’s development, are unfortunate as nearly 40
141 percent of the region’s population is land-locked without significant natural resource
142 endowments (UNIDO, 2004, p. 20). Moreover, the amounts of rain and its distribution are
143 highly unpredictable, especially in Western and Central Africa. These areas suffer from
144 chronic droughts, crop failure and a subsequent rise in food prices. Ironically, East Africa
145 has been struck by record rainfalls, which led to disastrous flooding and internally
146 displaced persons. Therefore, the rapid change of the climate might be assumed as an
147 obstacle for development, inter alia because the rise in temperature has caused the
148 agricultural sector to stagnate. The theory by Bloom and Sachs (1998) could support the
149 argument that the region is poor due to its natural circumstances and endowments should
150 not be disregarded. It emphasizes that it might be difficult to achieve economic growth
151 with a lower coastal-land ratio, a higher proportion of land in the tropics and high latitudes,

152 all of which are criteria applicable to the region. However, there are many other factors,
153 mainly “assimilation policy”, “indirect rule”, and “slave trade” that led to the
154 underdevelopment of the region as briefly explained below.

155

156

157 *2.1. Assimilation policy*

158 Assimilation policy is originated from the surviving fragments of the first French empire
159 during the Revolution of 1789. The theory behind the policy could be traced to Nicolas de
160 Condorcet's (1743-1794) famous phrase: "a good law is good for all men, just as a sound
161 logical proposition is sound everywhere" (Lewis, 1962, p. 134). Accordingly, the French
162 assimilation concept was first based on the idea of expanding French culture to the colonies
163 outside of France between the 19th and 20th centuries through attempting to turn Africans
164 into the French civil norms. Consequently, the French language was intentionally teaching
165 at schools and churches, along with the French history and other cultural aspects of the
166 country. As a result, the colonies were considered French citizens as long as the French
167 culture and customs could be adopted. This also meant they would have the rights and
168 duties of the French citizens.

169 As soon as the 19th century drew to an end, the criticism of assimilation became harsher
170 (Ginio, 2006). The meaning of assimilation was increasingly criticized, mainly because it
171 was based on the superiority of French culture and civilization. The (French) laws were
172 applying to all colonies regardless of all dissimilarities (Van Den Berghe, 1962). As a
173 result, little attention was paid to the political, social, and economic development of the
174 colonial countries. African societies were presumed to have no history or civilization,
175 largely in a state of war and flux. Africans were basically the subjects of France, not
176 citizens, and had no political rights or the rights of representation. However, there was also
177 a growing recognition that Africans had a very different culture.

178

179 *2.2. Indirect rule*

180 Indirect rule was a governmental system developed in certain British colonial
181 dependencies, dominantly in parts of Africa and Asia. Due to this system, much of the

182 habitual government of localities was left in the hands of local rulers who have gained their
183 prestige and stability traditionally (even if at the cost of a loss of autonomy). The system
184 thus allowed a limited number of European colonial administrators (mostly British) to
185 effectively manage the government of great numbers of inhabitants spread over large areas
186 (Olson, 2002).

187 While indirect rule was cheaper and easier for colonial authorities, and in practice, it
188 needed fewer administrators; it made a number of problems. In many cases, the authorities
189 significantly empowered local leaders. This is especially true in the case of the monarchy
190 of Uganda. On the other hand, if no workable authority upon, to the Western definition,
191 was available, the colonizers would simply decide on their own local administrative
192 officers who might not always be supported by the laypeople. The officers were often
193 selecting those local leaders who held the most similarities to them than to native leaders.
194 Moreover, most officers were conservative that was opening a narrow outlook to the
195 public, more especially to marginal people like women and young generation. Unwritten
196 oral laws were replaced by officially legalized laws which were less flexible to the people
197 and traditional customs. Consequently, the customs and old justice had no function
198 anymore while the society was neither prepared to go for the new rules. Additionally, the
199 new empowered leaders by the colonial governments were often not familiar with their
200 new tasks (such as recruitment and tax) either. As a result, an increase in crime and
201 violation happened (Collins and Burns, 2007).

202 Many authors (Boone, 1994; Mamdani, 1996; Migdal, 1988) have already showed how the
203 institutional legacies of the indirect rules created ineffective central administrations and
204 empowered non-skilled local officers, and thereby launched a system of decentralized
205 autocracy that has made the state too ineffective to nearly be collapsed (Lange, 2004).

206

207 2.3. *Slave trade*

208 The dispute about the role of the slave trade economy has led to a controversy in both
209 academics and non-academic world on whether the trade has brought up SSA with
210 negative or positive outcomes impacts (Orji, 2008).

211 From the historically point of view, slavery has had an important role in the SSA's
212 underdevelopment because it has not only promoted ethnic fractionalisation but also
213 destabilized effective states. A shoddier fact is that the most slaves were exploited from the
214 most politically underdeveloped regions that are still the most ethnically fragmented today.
215 According to Nunn (2008) without the slave trade, 72% of Africa's income gap with the
216 rest of the world would not exist today. Accordingly, he considers a negative causality
217 between slave trade and the current economic status in Africa. He discusses that the slave
218 trade has prevented the development of the states, increased ethnic fractionalisation and
219 declined legal institutions which have significantly postponed the economic development
220 of the region (Kumo, 2009).

221 Due to some African historians (Gemery and Hogendorn 1979; Inikori 1992; Manning
222 1981), the vulnerable effects of the slave trade are laid on the institutions and structures of
223 African societies. The historical evidence of their case studies explains how the slave trade
224 has induced politically instable and socially unable states. It has also led to socio-political
225 fragmentation, and resulted in a corrosion of local institutions. Upon to this vision, Africa's
226 engagement in the slave trade should be understood as one of the main causes of massive
227 depopulation in the continent. Bhattacharyya (2007, p. 2) further regards it as a cause to an
228 implosion of the continent's production possibility frontier and an unambiguous reduction
229 in welfare. He believes that the secular decline in welfare continued even over more than
230 two centuries that has halted the continent with an economic backwardness.

231

232 Despite the above historical and exogenous factors, and although the factors cannot be
233 changed, many other factors that are disadvantageous for SSA can. Furthermore, if one
234 looks at the region as a whole, the natural factor endowments are not outstandingly
235 unfortunate as low population density is typical for the region and therefore, per capita
236 natural resource endowment ratio is rather favourable. Moreover, the region owns valuable
237 resources such as gold and diamonds in Sierra Leone and oil in Nigeria (Smilie et al., 2000 p.
238 17). Hence, a challenge for the region is to transform resources into income without
239 enlarging inequalities (Holmberg, 2007, p. 27). Yet, the extreme climate as an obstacle to
240 socio-economic development should not be disregarded.

241

242 **3. Essential measures for the enhancement of socio-economic development in Sub-** 243 **Saharan Africa**

244 When it comes to development measures and policies, many different theories exist as to from
245 which angle development strategies should be approached. There is no guarantee for the
246 “perfect strategy” as development is such a multifaceted process (Azadi et al., 2011c) and
247 regions such as SSA are complex and being influenced and shaped by many different factors.
248 Contrary to the global trend of large companies shifting production to developing countries
249 (which have cheap labour) and therewith enhancing their development, SSA has not had an
250 increase in manufacturing (King, 2010), due to a widening productivity gap, between
251 agriculture and manufacturing and between manufacturing and economy-wide productivity
252 (UNIDO, 2004, p. 40). Thus, industrialization needs to happen in the following way:

253 “Declining farm sector employment is offset by technological advances that raise
254 productivity in agriculture, while the demand for services grows in the transaction-
255 intensive manufacturing sector.”(UNIDO, 2004, p. 47)

256

257 The following sections explain how this should happen.

258

259 *3.1. Necessary changes in the economic structure*

260 According to the United Nations Industrial Development Organization (UNIDO, 2004, p. 33),
261 in order to attain a higher level of economic growth in SSA, the growth must undergo three
262 phases of structural change, namely a demographic transition, a structural change in
263 agriculture, and a compositional change within manufacturing. The demographic transition
264 brought about by a reduction in the fertility rate would:

265 “...reduce the denominator in the income per capita indicator while releasing resources
266 for investment in human capital, with the net effect of raising human capital per
267 capita.”(UNIDO, 2004, p. 33).

268

269 The fewer children women have, the less unpaid (house) work they undertake, and the more
270 human capital will be released, as women have time to contribute to the economy. A lower
271 dependency ratio would lead to more productivity in the economy (Szmirai, 2005, p. 150).

272 Ultimately, the output of the economy will increase with the number of available workers and
273 the efficiency. Secondly, to boost the economic growth, an increase of productivity in the
274 agricultural sector needs to happen in order to increase output and free labour and resources
275 for the establishment of an industrial sector. This generally happens through irrigation, the use
276 of fertilizers and chemicals as well as improved seeds, mechanization and the enhanced rural
277 infrastructure. As income through agriculture grows, demand for goods (besides food) rises
278 that gives an impulse for the development of the manufacturing sector (Boserup, 2005; Diao
279 et al., 2007). Finally, to enable the manufacturing sector to absorb the surplus labour from the
280 agricultural sector, some reforms are required. Accordingly, a shift to produce more capital-
281 and skills-intensive activities is necessary. This could, for example, be a change from

282 producing textiles to industrial machineries or chemicals. To facilitate this change, some
283 improvements in human skills as well as the capacity to exploit advanced technologies are
284 needed. Supremely, as the manufacturing sector evolves, a service-sector originates. As
285 already mentioned, a large part of the population of SSA is land-locked which makes those
286 parts reliant on the export of regionally tradable goods (Ehui and Pender, 2005). Accordingly,
287 those regions are dependent upon the growth of purchasing power in the rest of the region
288 (Ndulu, 2006). Thus, development strategies need to address more than one state, and regional
289 integration needs to be a key factor of the development measures. Ideally, the land-locked
290 countries will be exporting food and services to their neighbours, which in turn trade
291 manufactured good and resources on the international market (UNIDO, 2004, p. 20). In the
292 coastal regions, it is important to become globally competitive in manufactures by using the
293 “central” location and lower per capita incomes as a comparative advantage in comparison to,
294 for instance, Asia.

295

296 *3.2. How to achieve a demographic transition*

297 It is often argued, that women in SSA have many children, due to their religious belief and
298 cultural traditions (Teller, 2009). However, according to the theory of “demographic
299 transition”, a reduction in fertility rate usually happens as soon as income-levels rise without a
300 conversion to a different faith (Smirzai, 2005, p. 146). Child-mortality decreases as soon as
301 wealth is accumulated and health systems as well as social security system improve.
302 Especially in rural areas, children function as a guarantee for future, as they will be able to
303 work and feed their parents once they are old. As soon as parents know that the child-
304 mortality is low, fertility rate usually decreases. Secondly, if there was a public system of
305 social security that could look after the parents in their elderly age, fertility rates would
306 decrease as well. However, in this situation, a reduction of the fertility rate should be achieved

307 not due to economic growth, but rather as a prerequisite for economic growth. Thus, if foreign
308 direct investments could assist in building up social security systems and health care, as long
309 as states are not able to deal with it without external help, the fertility rate would start
310 decreasing and then lead to self-sustained development.

311 Furthermore, other factors like HIV/AIDS, sanitation, road accidents, wars and insecurity are
312 important determinants to achieve a successful demographic transition in the region.
313 According to Andoh et al.'s (2006, p. 630) findings, the HIV/AIDS infection rate is
314 significantly associated with adult mortalities and lower life expectancy, but negatively
315 associated with infant and maternal mortality rate. This is because the adult population is at
316 risk of HIV/AIDS infection, as sexual relations are the main mode of transmission in SSA.
317 Their findings need to be interpreted in the context of an association between HIV/AIDS and
318 education. In another analysis by Walker et al. (2002), a positive association was found
319 between infection rate of HIV/AIDS and education. Moreover, throughout the region,
320 dramatic improvements could be emerged largely from the improved sanitation and safer
321 water. According to Bloom and Canning (2000), decreased infant and child mortality,
322 combined with the increased life expectancy and finally a fall in fertility could be brought
323 about by improved sanitations. Both HIV/AIDS and sanitation have already been targeted by
324 the MDGs (see: <http://www.un.org/millenniumgoals/>). Developing safer sanitation system has
325 already been launched by Professor Muhammad Yunus when developing the Grameen Bank
326 (see: <http://www.grameen.com/>).

327 Yet, to achieve a feasible demographic transition, road accidents should also be addressed. In
328 SSA, such accidents are one of the main classes involved in fatal accidents (Jacobs and
329 Aeron-Thomas, 2000) that have resulted from unsafe roads (Elvik et al., 2009) contributing
330 significantly to the demographic transition. Lastly, wars and insecurity have been traditionally
331 (Omran, 1971) understood as the two main causes of demographical change worldwide

332 (Cleland et al., 1994; Lee, 2003), and more recently in the Horn of Africa where the region
333 suffers much from social conflicts (Tareke, 2009) that has worsened food insecurity in the
334 region (Azadi et al., 2011b; Bazuin et al., 2011).

335

336 *3.3. How to stimulate agricultural development*

337 The urban biases from governments, which are perceivable in parts of SSA and have led to
338 massive waves of immigration to urban centres, need to be transformed into recognition of the
339 agricultural sector's importance:

340 "Where government policy discourages agricultural production and encourages
341 agricultural imports to supply urban needs, there will be no positive impact of
342 urbanization on agriculture" (Cleaver, 1993, p. 89).

343

344 Politicians exert pressure on farmers to keep food prices low (Koning, 2002; Ashby, 2003).
345 Moreover, the urban bias exacerbates the marginalization of women and elderly people in
346 rural areas while young men should work in urban centres. Thus, women, who also need to
347 take care of their children and the elderly, feel more responsibility on their shoulders because
348 they still need to work in farms as well. Moreover, the urban bias erases the mere possibilities
349 of investing into more efficient techniques of production. There is a pressing need for a
350 redistribution of (as well as markets for) agricultural products:

351 "Spread-out rural towns and secondary cities tend to be associated with far greater
352 penetration of rural areas with adequate transport links and marketing arrangements
353 than when urbanization has focused on mega-cities" (Cleaver, 1993, p. 89).

354

355 Thus, a strong and accountable state is necessary in order to prevent lobbying from urban
356 elites and to develop a comprehensive approach that aims at finding a balance between rural

357 and urban areas in public investment, especially in infrastructures. This includes the
358 promotion of small and medium industries (through credit and fiscal policies), public
359 expenditure in secondary cities and well-distributed infrastructure investment. The result
360 would be rapid agricultural growth, sustained by urban growth, which would create markets
361 for agricultural products as well as providing enough supplies for farms' inputs. Thus, the
362 international community should invest in strong and accountable governments, through loans
363 that are connected to the condition of achieving the just mentioned goals through the right
364 investments (Cleaver, 1993, p. 90). Even if urban bias were to be entirely eradicated, there is
365 still the problem of getting farmers to produce more efficiently and to take risks such as using
366 new fertilizers or enhanced seeds with which they might not be familiar. A farmer, who
367 produces just above subsistence-level, has no incentive to take any risks of changing the way
368 he produces, as this could lead to a food shortage for his own family. Thus, local governments
369 need to create an enabling environment of predictability through ensuring contract
370 enforcement which would lead to the consolidation of private investments into technologies
371 and more efficient modes of productions. Besides, farmers need insurances for the cases of
372 unpredictable crop losses caused by extreme weather (Smirzai, 2005, p. 272). Hence, a strong,
373 effective and accountable state is not only necessary for an environment of predictability, but
374 also in order to prevent warlordism and the exploitation of natural resources by foreign
375 companies. It can be very unfortunate for the development if foreign companies establish
376 corruption-alliances with local governments, as has happened, for instances, in the
377 Democratic Republic of Congo, Sierra Leone, or in Nigeria (Lezhnev, 2005, p. 17).

378

379 *3.4. How to achieve a shift in the manufacturing sector*

380 As already exemplified, the development and improvement of the manufacturing sector
381 depends on the development of agricultural sector. The more the sector grows productively,

382 the more labour and raw materials can go to the manufacturing sector. In order to be able to
383 absorb the large influx, improved human skills as well as the capacity to exploit advanced
384 technologies are necessary for a shift to producing more skills- and capital-intensive products:

385 “This submits to the SSA countries a compound challenge- to assimilate and adapt the
386 well-tried technologies required to diversify their productive structure while upgrading
387 their ability to benefit from emerging technologies, and thus be able to compete in
388 international markets” (UNIDO, 2004, p. 109).

389

390 The purchase of advanced technologies and higher education on a large scale could be
391 financed through external loans or aids. To be able to use advanced technologies, it is
392 necessary to build capabilities and networks among public institutions (e.g. universities),
393 industry support organizations, and banks. Ideally, a close institutional cooperation would
394 lead to a higher number of skilled workers, fair credit-awarding systems and investment from
395 industry support organizations for specific projects (UNIDO, 2004, p. 52). For the
396 achievement of these goals, many actors; such as independent credit-institutes, foreign
397 companies and states that provide new technologies and national governments are important
398 to create the mentioned environment of predictability. It should be noted that in the three parts
399 of the structural transformation, the ultimate goal is self-sustainability for SSA; i.e. to be able
400 to develop independently.

401

402 **4. Effects of pollution, environmentally harmful practises and global warming on** 403 **Sub-Saharan Africa**

404 In this section, the direct link between global warming, pollution and underdevelopment in
405 SSA is stressed in order to emphasize on the importance of eco-friendly development
406 measures. There is a direct link between global warming and economic efficiency

407 (Thornton et al., 2008). Most economic activities in SSA are based on its natural resource-
408 endowments. As already mentioned, the region is heavily reliant on the export of primary
409 goods. Although the need to carry out structural adjustments policies in order to change the
410 reliance on the export of volatile goods is increasingly understood, the adjustments remain
411 as a time consuming and long-run process. The agricultural sector is important in the early
412 stages of development as a source of: food, industrial labour, domestic savings, market for
413 industrial products, and foreign currency for agricultural exports (Smirzai, 2005, p. 274).
414 Thus, stagnation in the primary sector will halt the development of manufacturing
415 industries. While sustainable development needs to be achieved through economic growth,
416 social justice and environmental integrity (Saundry, 2008), to maximize the outputs, much
417 pressure is put on natural resources with little attention to sustainability. Fertilizers and
418 pesticides often contaminate drinking water, which significantly endangers human and
419 environmental health in some regions while the demand for water is arising in agricultural
420 sector and mining (mining is done through the clearing of vegetative cover in sensitive
421 water catchment areas and forests). In case of further agricultural growth, social conflicts
422 and poverty seem probable. When farmers in SSA attempt to get access to more land for
423 cultivation, deforestation (the clearing of forests through fire) is widely practised. The
424 Ivory Coast and Nigeria each accounts for about 5-6% of the 20% of global warming that
425 can be attributed to deforestation (Glantz, 1992, p. 6). Many areas of the continent are
426 already subjected to recurring droughts as a consequence of the increasing average in
427 global temperature. According to UNEP (2002, p. 51), SSA is the most vulnerable area to
428 climate change due to its propensity for drought and desertification, its dependency on
429 subsistence agriculture, and its vulnerability to poor rainfall. The limited economic
430 resources which would serve to mitigate the consequences of the increased frequency and
431 intensity of natural disasters, cause a situation in which even a slight change in climate can

432 be a big disaster in the region (UNEP, 2002, p. 50). Horrifyingly, the most recent report by
433 Nelson at IFPRI, predicts that a loss in the average of wheat yields up to 22 percent by
434 2050, as a result of climate change in SSA, since the region it will be too hot to grow
435 certain crops like wheat (Walsh, 2009). In tropical and subtropical regions, such as Central,
436 Western and Southern Africa, where some crops grow near their maximum temperature
437 tolerance and where drylands and non-irrigated agriculture are dominated, yields are likely
438 to decline due to even small climate changes (Beg et al., 2002, p. 4). Further, Nelson states
439 that irrigation water supply will decrease and, subsequently, food availability will lessen an
440 average of 500 calories per person per day. Further, the majority of the population in SSA
441 live in rural areas where income and employment depend almost entirely on rain-fed
442 agriculture. According to the United Nations Environment Programme, due to global
443 warming, the region is being faced with:

444 “...warming between 0.2°C and 0.5°C per decade, with 10% less rainfall in interior
445 regions under intermediate global warming scenarios, and water losses increased by
446 rising temperatures...Climate-induced changes to crop yields and ecosystem boundaries
447 will dramatically affect some of the poorest people in sub-Saharan Africa partly because
448 many of them live in areas most prone to extreme climate events and partly because
449 they have little capacity to adapt by turning to irrigated agriculture, improved seeds or
450 alternative livelihoods“ (UNEP, 2002, p. 62).

451

452 It has been predicted that an overall loss in agricultural production can be expected during
453 the next century (Beg et al., 2002, p. 4-5). As stated in “Climate Policy review”:

454 “Beyond the direct economic impacts, crop failure due to climate change could also
455 increase unemployment, destabilise food security, further increase competition for
456 scarce resources, and increase social inequity” (Beg et al., 2002, p. 133).

457

458 Furthermore, global warming will increase evapotranspiration rates which could create
459 moisture stress in certain plants, necessitating a need for supplemental water supplies in
460 response to decreases in soil moisture. It should be noted however, that droughts and the
461 rising temperature do not cause underdevelopment per se. Droughts are more likely to cause
462 famines in case that the state is shaken by internal conflict or civil wars and, accordingly does
463 not have the capacities to adjust its structure in order to deal with the effects of the heat
464 (Glantz, 1992, p. 2). Another consequence of global warming is the rise of the sea level,
465 which could pose a threat to Sub-Saharan Africa's Coastal regions. If, for instance, the sea
466 level were to rise one metre in the near future, African river deltas would be at great
467 risk of inundation. Thus in the future, the region could be shaken not only by long-lasting
468 droughts that lessen agricultural productions and lead to water shortages, but also by floods
469 that demolish agricultural crops. More specifically, Central Africa will be facing increased
470 precipitation, soil moisture and run-off that will change flooding patterns, increase the
471 contamination risk of freshwater supplies and encourage outbreaks of water-borne diseases.
472 Malaria will thus be spread to higher altitudes, while it was previously limited to lower
473 altitudes due to low temperatures and less rain in the mountains (UNEP, 2002, p. 46). The
474 increased rainfall has shown to often have a negative impact on the likelihood of social
475 conflicts (Hendrix and Glaser, 2007, p. 4). As explained earlier, internal conflicts are part of
476 the reason for SSA's underdevelopment. Accordingly, climate change will be an impediment
477 to achieve development goals like combating poverty, food security, enabling access to basic
478 services such as clean water, sanitary living conditions, energy, and education.
479 Additionally, a new environmental problem is emerging in SSA, namely ambient air pollution
480 in urban centres, especially in South Africa. The increasing levels of toxic pollutants pose a
481 threat to human health and atmosphere (UNEP, 2002, p. 51). This is due to population growth

482 and urbanization that put pressure on transport systems and lead to the increased vehicle
483 emission, especially because most vehicles are old and thus have a high level of toxic
484 emissions (Abam and Unachukwu, 2009, p. 551). Another reason for the newly emerged
485 problems is the high emission of burning coal, wood and other fuels in order to meet domestic
486 energy requirements (UNEP, 2002, p. 29-30). Although it is now clear that environmental
487 protection is vital for socio-economic development, it should be noted that, in the discussion
488 of environmental measures in SSA, a distinction needs to be made between the measures
489 against global warming in general and those against the local environmental problems. The
490 latter include environmentally harmful practices in farming and mining and their
491 consequences. Thus, a dual approach to improve the environment is necessary. In conclusion,
492 SSA is, in comparison, extensively affected by the increase in global temperature due to many
493 different factors. Especially, because the income levels are low and the population relies on
494 agricultural outputs which are volatile and sensitive to changes in climate and rainfall. Thus,
495 effects that the change and the careless treatments of the environment have in SSA are with no
496 doubt not only harmful to economic growth but also to the region and its people in general
497 and could lead to devastating consequences for the whole continent. For example, the Horn of
498 Africa is historically faced with chronic and currently acute droughts which together with
499 inappropriate policies of land tenure systems (Azadi et al., 2011b) have caused a significant
500 loss in agricultural productions resulted in a widespread famine (Bazuin et al., 2011).
501 Furthermore, climate change and agricultural downturn in the region have forced the
502 population (most importantly pastoralists) to move and cause conflicts over land territory
503 (Barrios et al., 2006). Another example, according to Abdalla (2006) is in Sudan where the
504 dried wells are a part of the Darfur crisis. Some links between climate change and human
505 health are more complex. For instance, the predicted drought in SSA could increase the

506 incidence of HIV infection, as poor rural farming families move to cities where conditions
507 foster unsafe prostitution jobs (McMichael et al., 2008).

508

509 **5. What environmental measures can be taken alongside socio-economic development**
510 **measures?**

511 The next question after stressing on the role of environmental issues in SSA would be
512 “what can be done in order to improve environmental conditions?” To answer, we will
513 discuss the compatibility and incompatibility of the environmental issues with the
514 development measures. In SSA’s predominantly rural economies, solving environmental
515 problems and changing harmful practices means to ensure better living conditions for the
516 millions. According to Bertinelli et al., (2005) (contrary to the general academic opinion
517 and especially the EKC):

518 “... reduction in pollution may feasibly happen at a very early stage of economic
519 development”(Bertinelli, 2005, p. 4).

520

521 However, rising per capita income will not in itself ensure improvements in environmental
522 performance. The mentioned practices of deforestation and overexploitation of natural
523 resources need to be stopped urgently while farmers are increasingly maximizing their
524 profits by using all the natural endowments they have. Thus, some urgent interventions to
525 change such destructive behaviours need to be launched. For example, an incentive on the
526 award of tangible aid in the form of technologies or training could be offered. Also, the
527 agricultural insurance should be launched and extended. Furthermore, subsidies should be
528 given to promote technological improvements that care about global warming as well as
529 local environmental degradation threats. Surely, such interventions asks for huge money

530 (Ekins, 2000), however, we should not be forget that the costs are still lower than large
531 waves of refugees which can pose due to our careless attention to SSA's natural resources.

532

533 *5.1. Role of technology adoption in environmentally friendly development measures*

534 Many environmental problems of the region, especially those related to pollution are
535 connected to the age of technologies in use:

536 "Reduction in environmental pollution during the industrialization process is only
537 possible when the optimal rate of technological adoption has been reached" (
538 Bertinelli et al., 2005, p. 8)

539

540 According to their reasoning, traditional theories about the relationship between pollution
541 and socio-economic development, such as the Environmental Kuznets Curve by Grossman
542 and Kruger (1991), which conclude that underdeveloped regions cannot go for
543 environmentally friendly approaches, disregard the importance of the replacements of old
544 technologies. Hence, if technologies are replaced at the right time, a country, which is still
545 on the path of early industrialization, can be industrialized in an efficient as well as eco-
546 friendly way. Up until the attainment of the scrapping age, the output-pollution-ratio will
547 be increasing. However, thereafter, the ratio might be declined, depending on "... the
548 countries investment rates and willingness to improve technologies in terms of
549 environmental friendliness" (Bertinelli et al., 2005 p. 18). Yet, the question is whether it
550 would be possible to support developing countries in "... leapfrogging the adoption of
551 older technologies in order to fasten the pace towards cleaner development?" (Bertinelli et
552 al., 2005, p. 19).

553 Due to the urgency of increasing the environmental standards, this should definitely be
554 possible. Most African states do not have enough savings in order to buy more efficient

555 and eco-friendlier technologies. If loans were connected to the condition that efficient and
556 eco-friendly technologies would be bought by, it would be an investment into the fixed
557 costs of production, which would enable economies of scaling and therewith profiting
558 investors and, furthermore, improve environmental conditions.

559 “... much of the technology imported into developing countries is through second
560 hand machinery...the technologies embedded in imported second hand machinery,
561 however, tend to be much older than the state of the art and often have a dubious
562 environmental record...it has been estimated that the export of second-hand cars to
563 developing countries and emerging markets world-wider...will create additional
564 pollution of 1,8 million tonnes of carbon dioxide” (Bertinelli et al., 2005, p. 18).

565

566 Thus, if developed countries could stop exporting their old technologies to developing
567 countries and provided new but moderate prices technologies along with training how to
568 use them, such aids would influence global warming. Therefore, making profit through
569 selling old technologies should be forbidden. Providing new technologies at a moderate
570 price from abroad should only be a temporary solution since SSA needs to have enough
571 purchasing power to afford such technologies. Accordingly, the ‘countries investment rate’
572 should be determined by foreign direct investors. Also, bonuses (e.g. at the EU level)
573 should be prioritized for environmental-friendly techniques and innovations. If a high
574 standard of environmental protection is introduced right at the beginning of development
575 strategies, a negative link between industrialization and pollution and subsequent
576 stagnation of development will be prevented. In the course of development, sectorally and
577 regionally focused technology upgrading programs need to address more serious
578 environmental pollution problems in order to give SSA a chance of developing in a
579 sustainable manner. In addition, SSA needs support in recognizing the “scrapping age” of

580 technologies and introduction of eco-friendly technologies. With newer technologies,
581 productivity should be enhanced in the utilization of energy, water and material sources.
582 Sources such as solar energy, are often cheaper in the long run and also make the region
583 less dependent on the external energy resources.

584

585 *5.2. Necessity of developing in an environmentally friendly manner; institutional*
586 *arrangements for development*

587 As noted, in the African environmental outlook, there is a pressing need for radical changes
588 in technology "...if economic development is to proceed without adding to the existing
589 environmental challenges" (UNEP, 2002, p. 51). The so far economic developments are
590 mostly achieved by the measures that disregard environmental aspects. Besides, replacing
591 technologies in the process of industrialization in order to diminish global warming, the
592 Sub-Saharan African countries need to invest also in disaster preparedness. Some
593 environmental measures have already been successfully implemented in SSA by local
594 governments such as, the expansion of electrification programmes, promotion of unleaded,
595 and conversion to cleaner fuels (UNEP, 2002, p. 392). Moreover, the poorer and
596 landlocked countries in SSA will need considerable foreign supports in the immediate
597 preparation of disaster preparedness. Fundamental changes will still have to be made in the
598 energy and manufacturing industries as well as in transport systems in order to supply
599 sustainable energy, material and mobility to the future generations. Moreover, in the
600 context of global warming, it is important that all stakeholders (Azadi et al., 2011d) and
601 sectors of the economy mutually coordinate their actions. In Kenya, for instance, in order
602 to ensure cooperation, a National Climate Change Activities Coordinating Committee that
603 includes members from ministries of agriculture, forestry, energy, planning, finance and
604 industry, research institutes, municipal councils, public universities, the private sectors and

605 NGOs has been established. The committee coordinates and facilitates research, response
606 strategies, policy options, and public information and awareness (UNEP, 2002, p. 38).
607 Similar institutions can be found in most states of SSA, thus, a willingness to tackle the
608 problems and a general recognition of the need to coordinate are already being recognized.
609 Furthermore, environmental impact assessments should be made obligatory (like in the EU,
610 European Commission, 2009) for any new industrial or agricultural practice that could
611 eventually threaten the environment. It should, furthermore, also not be forgotten that
612 Central Africa's extensive tropical forests are carbon sinks and are very important and
613 effective in the process of mitigating green house gas emission. Thus, it is highly
614 important, not only because of the previously mentioned local negative effects of
615 deforestation but also in the global context, to establish a legal regime that protects those
616 large forest areas. Accordingly, environmental measures as the development improvements
617 strategies appear to be little puzzle-pieces which complete each other in constituting the
618 "big picture" of development. The theory of "development now, environment later"
619 (UNIDO, 2004) or "pollute first, clean up later" (Azadi et al., 2011c) is supported by the
620 fact that, most indicators show that environmental degradation first increases with growing
621 income and starts to decline after a turning point. Like the EKC curve, this theory suggests
622 to first wait for economic growth and general socio-economic development and wait until a
623 region has become rich and educated enough to be able to make the necessary adjustments
624 in the environment. It suggests that, otherwise, a country will not be able to compete in the
625 international market, as industrialization will always be slowed down as soon as
626 environmental effects are taken into account. In other words, a considerable increase in per
627 capita income levels is seen as a prerequisite for the environmental improvements as well.
628 However, critiques believe that there might not be enough time to "wait" for reaching high
629 economic growth due to the rapid speed at which the climate is changing. Bertinelli et al.

630 (2005) discuss that it is not the only possible way of development although they do not
631 present any evidence for the existence of the ECK. On the contrary, Azadi et al. (2011c)
632 present the case of Brazil, India, and China as successful evidence of the theory and with
633 some considerations, conclude that the “pollute first, clean up later” might still be feasible
634 for some developing countries.

635 Global warming, on the other hand, can only to a small part be attributed to SSA, as the
636 majority of global pollution has been caused by the industrialized nations (Norton, 2009).
637 Therefore, it is questionable why the region should make an effort to fight a global problem
638 of which it is the main victim, but which was mostly caused by the industrialized nations.
639 Those states have, in comparison, gained large wealth through environmentally harmful
640 practices and can now afford to take care of the environment. However, as explained, SSA
641 has no choice but to do everything that is possible in order to diminish the devastating
642 effects of global warming on its development. Moreover, industrializing in an
643 environmentally friendly way right from an early stage of development will have positive
644 long-term effects on the region. Nevertheless, as SSA’s contribution to climate change has
645 been little (Glantz, 1992, p. 5) the described environmental measures (which are quite often
646 costly and time-consuming and especially call for large investments into fixed costs) as an
647 integral part of a development strategy should, for the most part, be financed by
648 industrialized states. Indeed, the industrialized states are already legally obliged to help less
649 developed countries to work against climate change, through the Bali Action Plan and the
650 Kyoto protocol, according to which developed countries have the primary responsibility of
651 fighting global warming. Ideally, a legally binding agreement could be reached,
652 committing all countries in the world to the fight against climate change and, moreover,
653 establishing a global climate-fund, in which large and wealthy countries invest for the
654 benefit of developing countries. Such a fund would be regarded as a global investment into

655 the well being of the planet. Hence, it is by no means inevitable that SSA's development
656 will stagnate due to a lack of development aid and diminishing amounts of money available
657 for investment into development in favour of environment and attempts to tackle global
658 warming. Money made available for the fight against global warming should not be
659 distracted from development aid funds. Foreign finances should be taken from an
660 international fund to which states contribute according to their size and pollution-levels
661 instead of diminishing development-aid in favour of environment. On the other hand, local
662 measures, for example, deforestation and cultivation, lie in the responsibility of the region
663 itself, while certain ethics (such as not to dump old technologies and apply
664 environmentally-friendly investments) should not be disregarded.

665

666 *5.3. Environmental education and the need for attitudinal change of policy makers*

667 Additionally, the main focus of environmental education programs should be to change
668 environmental behaviour, through increasing environmental knowledge (Pooley and
669 O'Connor, 2000). The main goal of such programs should be to create pro-environmental
670 behaviour (Magnus et al., 1997), especially in the mind-set of policy makers (Hungerford &
671 Volk, 1990). The programs should aim to offer long term solutions to environmental problems
672 (Evans et al., 1996) of SSA and the main attention should be given how to change the values
673 and analytical skills of the policy makers both in SSA and the industrialized nations (Bradley
674 et al., 1997) to realize and accept the main causes of climate change when it comes to
675 understanding the contributions of different nations to the climate change. Without a correct
676 make up in the policy makers' mind, it would not be possible to make significant change in
677 the environmental issues of SSA. At present, most environmental programs have paid little
678 attention to the importance of changing the mind-set of 'policy makers' while they have

679 mostly focused on understanding and changing the perceptions of pastoralists (Ho and Azadi,
680 2010) or farmers (Zhao et al., 2011).

681

682 **6. Conclusion**

683 *6.1. Summary*

684 The field of analysis in this paper might have been a bit too wide, as a very large region was
685 treated. This simplification, however, was made because global warming has large effects on
686 a very wide area of land and people. Focussing on a single state would have narrowed the
687 analysis though the local measures were also taken into account. This analysis mostly
688 focussed on the internal changes that should be made regarding the development and how the
689 changes can be combined with the general objective of reducing global warming and
690 protecting the environment. However, it should not be forgotten that SSA is also retarded in
691 its development due to the international trade factors. These are, for instance, deteriorating
692 terms of trade, a large debt problem, fluctuating exchange rates, the failure to produce in a
693 way that is capable to compete with other regions and a possible structure of dependency.
694 Thus, as soon as one focuses on the international market, there are a lot more barriers to
695 SSA's development than described in this paper.

696

697 *6.2. Conclusion*

698 The simple answer to the question whether socio-economic development and environmental
699 improvement are reconcilable in SSA where the region is reliant heavily on agriculture, might
700 not be possible as it may outweighs all other arguments like postponing the environmental
701 measures. The consequences of only small rises in temperature in SSA could lead to the
702 deprivation of millions of people and the destruction of the largest sector of the economy in
703 SSA. Such consequences would make the development impossible at once, thus, arguments in

704 favour of “development first, environment later” should be cautioned since any underestimate
705 on the environmental impacts might create a large obstacle to sustainable development of the
706 region. Hence, environmental and developmental measures should be mutually regarded. As
707 discussed by Bertinelli et al., (2009), there is a way to industrialize the region in an
708 environmentally compatible way. Even though bringing the development measures to the
709 environmental standards might be more expensive and time consuming due to investments in
710 new industries, technologies or energy sector, it will be more beneficial in the long run. In this
711 respect, international aids are required to give SSA an initial push towards “greener”
712 development pathways. The environmental measures need to be an inherent part of current
713 development strategies and should not be regarded as a separate issue. Furthermore, the region
714 might not have time to “wait” for its own socio-economic development in order to accumulate
715 money to face the challenges of droughts, floods, connected diseases and rise of poverty. As
716 already exemplified, especially in tropical and subtropical regions in Central, Western and
717 Southern Africa, some crops exist near their maximum temperature tolerance and, hence,
718 already a small change in climate can have negative consequences in the sense that yield-
719 production will diminish considerably, depriving many small peasants of their income and
720 therewith making poor people poorer. Accordingly, there is no time to focus on development
721 first in order to make the region less vulnerable and more innovative. Rather, environmental
722 and socio-economic development must go “hand in hand”. If environmental policy
723 interventions play a role in earlier stages of development, it allows the Sub-Saharan African
724 countries to prevent an early harmful link between industrialization and pollution, which in
725 other states has caused global warming in the first place. However, to launch such green
726 pathways, the policy makers in industrialized nations need to realize that global warming as
727 well as regional environmental degradation are global problems, which will affect everyone
728 eventually. The policy makers should change their attitudes and acknowledge their

729 responsibility for the people suffering from global warming in SSA. This is an important
730 starting point of achieving socio-economic and environmental development in the frame of
731 green pathways in the region. Moreover, SSA is the region that contributed the least to but
732 suffering the most from global warming. One does not need to be convinced of the
733 dependency-theory in order to recognize the responsibility of industrialized and developed
734 nations in this respect. To assist SSA with developing in the most environmentally friendly
735 way, it must be seen as a global responsibility. If this necessity and responsibility are well-
736 understood and accepted by state-officials of all industrialized countries, every state should
737 contribute to an international fund to make the reconcilability possible.

738

739 *6.3. Recommendations*

740 In describing specific cases, the conclusion might then be reached that the region does have to
741 accumulate some wealth before it has the capacity to address certain environmental issues.
742 Furthermore, the described way of financing anti-climate change policies that was described is
743 not only hypothetical and an ideal imagination, but also a topic to be further analyzed in the
744 future studies of international laws. Only in the frame of such global acts, the responsibility of
745 industrialized and developed countries with regard to climate change can be legalized and
746 proceedable. Furthermore, the shift to produce more capital-and skills-intensive activities
747 should empirically be tested in a couple of SSA's nations to have some evidence regarding the
748 possibility of this strategy at hand. Thus, development studies need to address more than one
749 state, and regional integration needs to be investigated as a key factor in these studies. Lastly,
750 the problem of accountability of the Sub-Saharan African nations and the difficulties in
751 monitoring whether or not foreign aids are used correctly by them should be the other
752 important issues to be addressed in the future studies.

753

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