Gender disparities in rural education attainments and agricultural landownership from the perspective of Sustainable Development Goals (SDGs): evidence from 16 Sub-Sahara African countries

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Abstract

Purpose – The purpose of this study is to explore the relationship between gender disparities in rural education attainments and agricultural landownership (ALO) in Sub-Sahara Africa with Sustainable Development Goal (SDG) perspective.

Design/methodology/approach – This study uses SDG indicators interactions and pairwise correlation analysis.

Findings – There is a significant negative association between gender disparities in rural education attainments and ALO in Sub-Sahara Africa. Such negative relationship is not influenced by national economic development and living standards.

Research limitations/implications – The data is limited with 16 Sub-Sahara African countries, and as this is an early output of a number of follow-up studies in the author's plan, the methodology is relatively simple.

Practical implications – Reducing gender disparity in rural Sub-Sahara Africa especially in ALO requires more integrated approaches which also address other aspects of sustainable development. This is particularly the situation because of the strong male-favored customary practices in rural Sub-Sahara Africa. The prioritization of different dimensions of sustainable development is also important in Sub-Sahara Africa.

Social implications – Strong awareness of SDGs is important. Further efforts in collecting data for and use data of sustainable development, especially the SDGs, are essential. Emerging trend of studying the interactions across SDGs reflects the future direction of relevant fields.

Originality/value – This paper has high originality because it is an early-stage research in the SDG interactions in Sub-Sahara African countries with the perspective of gender, gender disparity, Sub-Sahara

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Africa, SDGs, ALO and rural education attainments. This paper has both academic and practical values because of its innovative research thoughts and policy-oriented implications.

Keywords SDGs, Sub-Sahara Africa, Gender disparity, Agricultural landownership, Rural education attainments

Paper type Research paper

1. Introduction

The 17 Sustainable Development Goals (SDGs) are at the heart of the 2030 Agenda for Sustainable Development, which was adopted by the United Nations (UN) as a global blueprint to achieve sustainable peace and prosperity by addressing urgent challenges (UN, 2016). As reported by the Inter-agency and Expert Group on SDGs (IAEG-SDGs) Indicators in March 2021, there are 169 targets and 231 unique indicators to monitor, measure and evaluate the progress at the national and international levels to achieve the 17 SDGs (IAEG-SDGs, 2021). Compared with the Millennium Development Goals, SDGs have more comprehensive coverage of the gender dimension of sustainable development. For example, gender disparity in education completion and gender difference in agricultural landownership (ALO) are both SDG indicators (IAEG-SDGs, 2021).

By using the SDG Global Database (UN, 2021), this article explores the relationship between gender disparity in rural education and ALO in Sub-Saharan Africa. As shown by SDG Indicator 4.5.1, gender disparity in rural education is an important reflection of the gap in the access to and completion of education (at corresponding levels) between males and females living in rural areas. It is a widely discussed issue in both academia and the policy arena because of its direct relevance to essential aspects of sustainable development such as poverty, human capital and family livelihood, especially in rural areas (Dong, Li, Yang, & Zhang, 2008). In addition, gender disparity in education in the rural regions can reflect the geographical coverage and population inclusiveness of education, especially in developing countries, which in general have a relatively higher percentage of rural population.

Gender disparity in ALO is also directly related to various aspects of sustainable development, especially in rural areas, such as food security and migration (Murphy, 2021; Nnaji, Ratna, & Renwick, 2021). For example, the UN Food and Agriculture Organization shows that in comparison with males, females are in disadvantaged positions concerning land rights, although the proportion of female landholders varies across countries (FAO, 2018). Because of its strong connection with women's empowerment (especially in rural areas) and females' access and control of essential economic and productive resources, gender disparity in ALO is accepted as an SDG indicator (Brunelli & Gurbuzer, 2021).

Existing studies demonstrate a substantial gender difference in ALO in Sub-Sahara African countries. For example, only around 20% of agricultural landowners (ALOers) in Nigeria are female, and only less than 5% of women in the agriculture sector own land solely (FAO, 2018, p. 2). Similarly, in Burkina Faso and Burundi, only around one in ten women in the agriculture sector has solely owned land, but this figure for men in both countries is over 40% (FAO, 2018, p. 2). In addition, gender disparity in access and education completion is also significant in Sub-Saharan Africa. For example, in rural Eritrea, the gender disparity in education is significant, as reflected by the different literacy rates of males and females, possibly because of rural girls being more likely to be put to work (Rena, 2005). This also impedes girls in rural Malawi's access to education (Kachiwanda, 2010). Such substantial gender gaps in both ALO and rural education in Sub-Sahara African countries, plus the relatively strong reliance on agriculture in the sustainable development of these countries, call for more studies on the connections between gender disparity in rural education and

ALO in Sub-Saharan Africa. Evidence from these countries will not only enrich scientific knowledge but also generate practical implications, especially for the policies that aim to promote women's empowerment. Furthermore, experiences and lessons from Sub-Saharan Africa can also generate suitable lessons from which other countries can benefit if the differences in country contexts are carefully considered.

Despite the author's best efforts in literature search, the existing studies on the relationship between gender differences in ALO and rural education, especially in Sub-Saharan Africa, are insufficient. In addition, little research is based on national or cross-country data, reducing evidence and implications at macro levels. Furthermore, it is difficult to find previous literature addressing the association between gender disparity in rural education and ALO from the perspective of SDGs and their interactions. Therefore, this article aims to enrich the knowledge and practice in this field by bridging the literature gaps mentioned above. As an early-stage output of a series of studies in the author's plan, this article is mainly explorative without sophisticated methodologies. The two main objectives of this article are raising the scientific and practical awareness of gender disparities in ALO and rural education and encouraging more in-depth research and practice-oriented interventions in this field.

The remaining parts of the article will be organized as follows: the next section briefly reviews the most relevant literature, which identifies the literature gaps to be addressed. Section 3 introduces the data and methodology. Based on the previous sections, results are presented in Section 4, with findings discussed in the same section, which also generates a number of practical implications. Finally, Section 5 concludes the article with a summary of the findings, implications and spaces for future research.

2. Literature review

Existing literature on the association between gender disparity in rural education and the gender gap in ALO can be divided into two streams. The first considers education as a characteristic of rural households and explores whether and how the gender gap in education affects gender disparity in ALO. For example, Chigbu, Paradza, & Dachaga (2019) demonstrate the importance of women's education attainments in securing their land access and tenure based on evidence from Ghana, Nigeria and Zimbabwe. On the other hand, schooling is negatively related to women's ALO in Bangladesh, suggesting a possible substitute effect between investment in education and land (Kieran, Sproule, Quisumbing, & Doss, 2017). Furthermore, using the Oaxaca-Blinder decomposition, Daniel (2021) finds that, in Burkina Faso, gender disparity in education attainments (as reflected by literacy rate) is a reason for the gender gap in agriculture productivity, which leads to difficulties for women to own and manage agricultural lands. Meanwhile, gender gap in education attainments in Burkina Faso is primarily caused by the country's socio-cultural system (including customary practices), which also directly affects gender disparity in ALO (Daniel, 2021).

Previous studies show that such a socio-cultural system, especially customary practices, often favors males over females in accessing human capital and productive resources, including education and land. For example, Fonjong, Fombe, & Sama-Lang (2013) find that in Cameroon, even though formal institutions such as law and policies support gender equality in ALO, they are challenged by gender discriminatory customary practices. Furthermore, based on evidence from Kenya, Malawi, Senegal and Mozambique, Santpoort *et al.* (2021) demonstrate that the awareness of women's ALO is not sufficient. This is possibly because of women's disadvantage in education attainments, as it is usually crucial for civil society organizations to literally "translate" laws/regulations about ALO into easily understood expressions (such as local languages, dialects and terminologies) for local

communities (Santpoort *et al.*, 2021). In short, gender disparity in ALO can reflect an overall gender norm in Sub-Saharan Africa, which also influences gender disparity in rural education attainments.

In the other direction, the second stream of previous research considers ALO as part of household or individual socioeconomic status (SES) and examines whether and how gender disparity in ALO affects gender gaps in rural education attainments. For example, Meinzen-Dick, Quisumbing, Doss, & Theis (2019) conducted a systematic review and obtained evidence of a positive association between women's land rights and decision-making on human capital investment. By contrast, Muchomba (2017) shows that Ethiopia's joint land certification (registers both male household heads and their female spouses in the land certifications) reduces family education expenditures. That may reduce the opportunities for girls to attend proper education. Similarly, in Uganda, Nishimura, Yamano, & Sasaoka (2008) do not find a significant association between family land size and children's education attainments, although, at the secondary education level, such association is stronger for males than females. This suggests that the connections between gender gaps in rural education attainments and ALO vary across countries.

In addition, as shown by the two streams of existing literature, the relationships between gender disparity in rural education attainments and ALO can be two-way. In one direction, gender disparity in rural education attainments can be an SES indicator that impacts the gender gap in ALO. In another direction, gender disparity in ALO is also an aspect of SES influencing gender disparity in rural education attainments. Such endogeneity leads to difficulties in identifying and interpreting possible causal relationships between them, which deserve proper attention from further studies including this article.

In terms of data and methodology, previous studies usually use household or individual-level data collected by the researchers themselves (Fonjong *et al.*, 2013). Although nationwide official data are sometimes used (Nnaji *et al.*, 2021), they may not have adequate definitions of core concepts. This is particularly the situation in Sub-Sahara African countries, where ALO is not only defined and protected by formal institutions such as laws but also depends on *de facto* ownership in customary norms (Djurfeldt, 2020; Doss & Meinzen-Dick, 2020). Therefore, this article and future studies will aim to reduce these gaps in data and methods.

3. Data and methodology

3.1 Data

To address the existing gaps in obtaining adequate data to reflect the gender disparities in ALO (FAO, 2018), this article uses official data for SDG Indicator 5.a.1, obtained from the SDG Global Database (UN, 2021). The official data for SDG Indicator 5.a.1 consists of two parts: the proportion of the agricultural population with ALO by gender and the gender parity across agricultural land owners (FAO, 2021). The former is reflected by the number of people in agriculture with ALO divided by the total agricultural population (by gender), while the latter is defined by the percentage of female ALOers in all ALOers. The exact mathematical formulas are available in the metadata of SDG Indicator 5.a.1 (FAO, 2021).

FAO (2021) also defines the core concepts such as agricultural land and ALO. An advantage of the official data for SDG Indicator 5.a.1 is that it includes not only legally defined ALO with written documents but also *de facto* ALO if the land "holder" has the rights to sell or bequeath the land, even if there is no written document defining the ALO (FAO, 2021). This corresponds to the context of Sub-Saharan Africa, where ALO is widely defined and managed by customary practices rather than formal regulations (Djurfeldt, 2020).

This article adopts data for SDG Indicator 4.5.1 to reflect gender disparity in rural education attainments. This indicator monitors the gender parity indices (female/male) in education outcomes under the custody of UN Educational, Scientific and Cultural Organization (UNESCO). The specific parity index used in this paper is the gender disparity in the completion rate of lower secondary education in rural areas, which is the completion rate of lower secondary education for rural females divided by the figure for rural males (UNESCO, 2021). For example, if a country's parity index is 0.8, then that means the number of females with lower secondary education is 80% of the number of males with the same education in that country's rural areas. If the parity index is higher than 1, then it means that in rural areas, a higher proportion of females completed lower secondary education than males. The selection of lower secondary education as the target level is because, at previous levels, such as primary education, the adoption of compulsory education may not reflect the gender disparity in rural education attainments. In contrast, attending/completing higher levels of education such as university/college is heavily affected by many other factors such as cross-country differences in minimum working ages and marriage practices, which may not be able to reflect the gender disparities in rural education attainments properly.

Both SDG Indicator 4.5.1 and SDG Indicator 5.a.1 are Tier 2 indicators, which means that the countries do not regularly produce data for the indicators so the country coverage of these indicators is relatively small, even though the relevant concepts, methods and standards are clear and globally accepted (IAEG-SDGs, 2021). This brings difficulties in cross-country comparisons and is also a reason for this article to focus on Sub-Sahara African countries, for which these two SDG indicators have relatively less missing data. However, a few countries were excluded because of their relatively small agriculture sector and other considerations. For example, according to the World Bank (2021), in Lesotho, the value added by agriculture (including fishery and forestry) only contributed to 6.3% of its gross domestic product (GDP) in 2020. Therefore, Lesotho is not included in this article. In total, data for 16 Sub-Sahara African countries are addressed in this article.

GDP per capita (purchasing power parity based on constant 2017 international US dollar, same below unless otherwise specified) is included into the data in this article, to show the levels of national economic development (World Bank, 2021). Also included is the country classification information based on gross national income per capita (World Bank, 2022), which is useful to show people's living standards in each country. In the context of Sub-Saharan Africa, most countries are low-income countries or lower-middle-income countries.

3.2 Methods

Based on the introduction of data in the previous sub-section, the gender gap in ALO is computed by the percentage of male ALOers in the total male agricultural population, minus the proportion of female ALOers in all female agricultural population. The differences are expressed in percentage points. If the value is negative, for example as in Malawi (shown in Table 1), then that means the proportion of male ALOers in male agricultural population is six percentage points lower than the proportion of female ALOers in the country's female agricultural population. The data for males and females are both from the same year, so the computation will not cause cross-year disturbances. The data for the gender gap in ALO and the proportion of female ALOers are also from the same year, although the exact years vary across countries.

In this article, the gender parity index data for rural lower secondary education completion (subtract from SDG Indicator 4.5.1) are either from the same year or earlier than

Country name	Gender gap in ALO	Proportion of female ALOers	Gender parity index for rural lower secondary education	GDPpc (PPP constant 2017 international $)	Country class
Benin	0.41	0.15	0.41	3,323	LMIC
Burkina Faso	0.42	0.18	0.28	2,156	LIC
Chad	0.30	0.38	0.39	1,519	LIC
Côte d'Ivoire	0.52	0.16	0.33	5,181	LMIC
Ethiopia	0.01	0.50	0.84	2,297	LIC
Guinea-Bissau	0.30	0.24	0.50	1,947	LIC
Malawi	−0.06	0.58	0.79	1,509	LIC
Mali	0.17	0.42	0.61	2,226	LIC
Niger	0.57	0.15	0.11	1,221	LIC
Nigeria	0.34	0.32	0.81	4,917	LMIC
Senegal	0.25	0.17	0.74	3,321	LMIC
Sierra Leone	0.09	0.47	0.71	1,637	LIC
Togo	0.33	0.23	0.61	2,108	LIC
Tanzania	0.05	0.50	0.89	2,635	LMIC
Uganda	0.18	0.41	0.78	2,175	LIC
Zambia	0.12	0.45	0.80	3,278	LMIC
Mean (simple)	*0.25*	*0.33*	*0.60*	*2,591*	*N/A*

Notes: 1. These are the most recent data available, although the exact years of data vary across countries. 2. Data are rounded-up to two decimal points, except GDPpc. Data for the gender gap in ALO are converted from percentage points, for example, 0.25 (Senegal) means around 25 percentage points. Data for female ALOers are converted from percent, for example, 0.17 (Senegal) means around 17%. 3. Data in the tables of this article are accessed in December 2021 and January 2022
Source: UN (2021) and World Bank (2021, 2022)

Table 1.
Full descriptive data

the data for the gender gap in ALO and the proportion of female ALOers. Therefore, there is no concern about endogeneity when exploring their association because of the antecede–postcede relationship. Or, in simple terms, something that happened earlier is usually not the cause of something that happened later. This also brings convenience for the article to examine the relationship between gender disparity in ALO and rural education attainments via pairwise correlation, which is a widely used method in studies on interactions across SDGs, including SDG indicators (Kynčlová, Upadhyaya and Nice, 2020; Liu, 2020). The simple method is also suitable for this article because of the relatively small data size. When conducting the correlations, the data for GDP per capita is taken into logarithmic terms as per standard practice. In addition, the Mann–Whitney U-test (Liu, 2022) is used for comparisons between low-income countries and lower-middle-income countries. Table 1 provides the complete picture of descriptive data.

4. Results and discussions

4.1 Statistical results

A quick overview of the descriptive data shows that, except for Malawi, women in the other 15 selected Sub-Sahara African countries are in relatively disadvantaged status in both ALO and rural education attainments (as reflected by the completion of lower secondary education). However, the situation in Tanzania is better than the other 14 countries, as it has the highest gender parity index for completing lower secondary education in rural areas and a relatively equal proportion of ALOers by gender (0.50 or 50%).

Table 2 is a summary of descriptive statistics. It reveals that there are cross-country disparities in gender gaps in ALO and gender differences in rural education attainments. However, the Mann–Whitney U-test shows that such gender disparities are not statistically significant according to the official classification of the country class based on gross national income per capita (World Bank, 2022), and in general, women are in disadvantage in ALO and lower secondary education, in comparison with their male peers. Figure 1 provides an overview of the descriptive statistics by country for the convenience of comparison.

Table 3 contains the main results of pairwise correlations between the gender gap in ALO, the proportion of female ALOers, the gender parity index for rural lower secondary education and the GDP_{pc} in the selected 16 Sub-Sahara African countries. It is consistent

	Mean	Median	SD	Maximum	Minimum
Overall					
Gender gap in ALO	0.25	0.27	0.18	0.57	−0.06
Proportion of female ALOers	0.33	0.35	0.15	0.58	0.15
Gender parity index for rural lower secondary education	0.60	0.66	0.23	0.89	0.11
GDPpc (PPP constant 2017 international $)	2,591	2,201	1,155	5,181	1,221
LIC					
Gender gap in ALO	0.23	0.24	0.19	0.57	−0.06
Proportion of female ALOers	0.36	0.40	0.15	0.58	0.15
Gender parity index for rural lower secondary education	0.56	0.61	0.24	0.84	0.11
GDPpc (PPP constant 2017 international $)	1,880	2,028	376	2,297	1,221
LMIC					
Gender gap in ALO	0.28	0.29	0.18	0.52	0.05
Proportion of female ALOers	0.29	0.24	0.15	0.50	0.15
Gender parity index for rural lower secondary education	0.66	0.77	0.23	0.89	0.33
GDP_{pc} (PPP constant 2017 international $)	3,776	3,322	1,024	5,181	2,635

Notes: 1. Data round-ups are the same as in Table 1. 2. Mann–Whitney U-test shows no statistically significant difference between LIC and LMIC in gender gap in ALO, proportion of female ALOers and gender parity index for rural lower secondary education. The exact results are not shown in the table because of space limitations

Source: UN (2021) and World Bank (2021, 2022)

Table 2. Summary of descriptive statistics (overall and by country class)

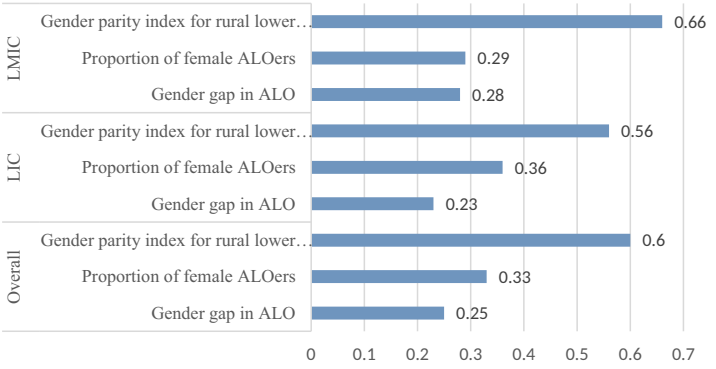

Figure 1. Descriptive data (Overview)

with the conventional wisdom and existing literature that gender disparity in ALO is negatively associated with the gender parity index for rural lower secondary education completion. Also, it is not beyond the popular belief that if the proportion of female ALOers is higher in a country, then there is a relatively higher female/male ratio (in rural areas) of completing lower secondary education. Both these correlations are statistically significant at 0.05 level. In addition, we can see that the two parts of SDG Indicator 5.a.1, the gender gap in ALO prevalence and the proportion of females among ALOers, are significantly and negatively associated. Again, this is also within the expectation of existing wisdom.

An unexpected result from Table 3 is that the level of national economic development in Sub-Sahara African countries, as reflected by GDP_{pc}, is significantly correlated with neither gender disparity in ALO nor gender gap in lower secondary education completion rate. Even further beyond conventional wisdom, Table 3 shows that if a country has a wider gender gap in ALO, then that country may have higher levels of economic development, as shown by a higher GDP_{pc}. These unconventional findings may be consistent with the results in Table 2, which suggest that official country classifications based on national income per capita do not strongly impact gender disparities in ALO and rural education attainments.

4.2 Discussion and implications

Statistical results in the previous sub-section can contribute to scientific dialogues and practical implications. For example, the significant correlation between gender disparity in ALO, including the proportion of female ALOers and the rural female/male ratio in completing lower secondary education, shows that improving rural females' access to education can contribute to reducing gender disparity in ALO. This provides evidence to existing studies such as Chigbu *et al.* (2019). This is particularly the situation when we notice that the data for the gender parity index for rural lower secondary education is earlier than or at least from the same year of data for gender disparity in ALO. On the other hand, because of the antecede–postcede order of data for these two SDG indicators, this article cannot explore whether and how gender disparity in ALO affects the gender gap in rural education attainments.

The negative association between the gender gap in ALO and the percentage of ALOers who are women demonstrates the consistency of the two parts of SDG Indicator 5.a.1. Such consistency may reduce the concern about the possible contradiction between these two parts, as they measure different aspects of ALO. However, in consideration of the possible disparity in the size of agricultural population between males and females, it is essential to consider the sampling weights when calculating data for SDG 5.a.1.

Gender disparity in ALO and gender gap in rural education attainments are both not significantly associated with the level of economic development (GDP_{pc}) and people's living standards (per capita national income) in these selected Sub-Sahara African countries. This is

	Gender gap in ALO	Proportion of female ALOers	Gender parity index for rural lower secondary education	Log (GDP_{pc})
Gender gap in ALO	1	−0.91*	−0.84*	0.20
Proportion of female ALOers	−0.91*	1	0.73*	−0.26
Gender parity index for rural lower secondary education	−0.84*	0.73*	1	0.23
Log(GDP_{pc})	0.20	−0.26	0.23	1

Table 3.
Correlation results

Note: * Means statistically significant at 0.05 level

beyond the widespread belief that more developed countries with higher living standards usually support women's empowerment more substantially, especially in agriculture and rural areas. The reasons for this unconventional finding perhaps include the overall strong male-dominant customary practices in Sub-Saharan Africa (Fonjong *et al.*, 2013). Another possible reason is the existence of gender disparity in agricultural productivity in Sub-Saharan Africa (Daniel, 2021). That means countries with higher gender disparity in ALO may have more productive agriculture sectors, so countries with relatively higher economic development may not necessarily witness a smaller gender gap in ALO. This is particularly the situation in these selected Sub-Sahara African countries, where agriculture's contribution to the economy is substantial.

Several scientific and practical implications can be generated from this article. The continuing efforts to improve data collection and expand data coverage should be encouraged and supported. Regular updates of relevant metadata and data collection methods by the custodian agencies of SDG Indicators 4.5.1 and 5.a.1 would be necessary. For example, because of the existence of unwritten ALO in Sub-Saharan Africa and the fact that formal land titling requires substantial extra costs (Atwood, 1990), it would be useful to consider further identifying *de facto* ALO in Sub-Saharan Africa and collect data accordingly. Proper setting of weights is also necessary in case of sharp gender imbalance in the agricultural population so that this indicator can reflect the exact situation of gender disparity in ALO.

The connection between SDG Indicators 4.5.1 and 5.a.1 provides evidence to support the emerging trend of research on the interactions across SDGs, including different SDG indicators (Le Blance, 2015; Liu, 2021), as well as the exploration of the multi-dimensional nature of rural development and gender inequality (Tirivayi, Knowles, & Davis, 2016; UNICEF Innocenti, 2020). Empirical studies on gender-sensitive rural development and SDGs based on reliable data should be particularly encouraged. These studies can expand academic knowledge in relevant fields and generate more suitable evidence for policy recommendations. The cross-organization 50 × 2030 Initiative (Brunelli, 2021), UNICEF's Gender Responsive and Age Sensitive Social Protection project (UNICEF Innocenti, 2020) and UNICEF's Data Must Speak project (UNICEF Innocenti, 2021) are good examples of efforts in data collection and practice-oriented research at both national and international levels. Researchers and practitioners can learn experiences and lessons from these efforts.

The statistically significant correlation between gender disparity in rural education attainments and gender gap in ALO in selected Sub-Sahara African countries calls for more integrated approaches to policy interventions in improving gender equality in rural areas, especially in ALO. For example, as the gender gap in rural education attainments could be a reason for gender disparity in ALO, policy interventions aiming to reduce gender disparity in ALO should focus on not only ALO itself but also other associated aspects such as education. Gender inequality is a multi-dimensional issue as manifested by the inclusion of relevant aspects into different SDGs, similar to land rights (Katila, McDermott, Larson, Aggarwal, & Giessen, 2020). Therefore, land reform policies in Sub-Saharan Africa should be more comprehensive, inclusive and gender-sensitive. Relevant policies should also consider customary practices to address the challenges in promoting gender equality in ALO in Sub-Sahara African countries.

5. Conclusion

This article explores the connection between the gender disparity in rural education attainments and the gender gap in ALO from the angle of SDGs. Country-level data shows that the female/male ratio of completing lower secondary education in rural Sub-Saharan Africa is significantly and negatively associated with gender disparity in ALO. This finding is consistent with existing literature and conventional wisdom.

It is beyond popular belief and previous knowledge that, in Sub-Saharan Africa, the levels of national economic development and people's living standards do not have a statistically significant relationship with either gender disparity in ALO or gender gap in rural education attainments. This is perhaps because of the widespread presence of customary practices and norms in Sub-Sahara Africa, which have a substantial influence on gender disparities in both rural education attainments and ALO. This demonstrates the multi-dimensional nature of gender inequality in ALO, which calls for more interdisciplinary studies and more integrated policy interventions, especially in Sub-Saharan Africa. Further research on the interactions across SDGs and SDG indicators is also needed to expand relevant scientific knowledge and evidence for practical implications.

As an early-stage output from a series of studies under the author's plan, this article is not without shortcomings and limitations. Although the custodian agencies of SDG indicators have contributed significantly to the data collection and country coverage, the available data for this article is still limited. Therefore, the article was unable to adopt more sophisticated statistical methods. In addition, because of the complexity in identifying ALO, such as the strong presence of customary practices (Atwood, 1990; Djurfeldt, 2020), the availability and quality of data for SDG Indicator 5.a.1 become challenges to the analysis in this article. Although the definition of ALO under SDG Indicator 5.a.1 includes both written/registered ALO and *de facto* ALO based on the rights to sell and bequeath (FAO, 2021), such definitions should be properly used in consideration of the disparities in countries' contexts.

Although the SDGs and SDG indicators comprehensively cover aspects of sustainable development, they are not exhaustive. For example, SDG Indicator 5.a.1 focuses on the gender inequality in ALO but does not address the differences in the size and quality of agricultural land owned by men and women. However, as introduced by Doss, Kovarik, Peterman, Quisumbing, & van den Bold (2015), the average size of land parcels solely owned by men is significantly larger than those solely owned by women in several Sub-Sahara African countries, which is also a gendered-land outcome. This limitation calls for more research examining factors related to gender inequality in ALO.

In short, this article contributes to knowledge by exploring the association between gender disparity in rural education attainments and gender gaps in ALO from the perspective of SDGs and providing practical implications based on evidence from Sub-Saharan Africa. However, this article's limitations leave space for future studies in this field. Therefore, further studies are encouraged based on more empirical data, more sophisticated methodologies and interdisciplinary approaches.

References

Atwood, D. A. (1990). Land registration in Africa: The impact on agricultural production. *World Development*, 18(5), 659–671. doi: https://doi.org/10.1016/0305-750X(90)90016-Q.

Brunelli, C., & Gurbuzer, Y. (2021). Methodological guideline for monitoring SDG indicator 5.a.1 – Gender parity in tenure rights over agricultural land. Data collection methods and calculation. FAO Statistics Working Paper 21-23. Rome, FAO.

Brunelli, C. (2021). Guide to 50x2030 survey tools and SDG indicator 5.a.1: Measuring gender parity in ownership and tenure rights over agricultural land. Retrieved from www.50x2030.org/sites/default/files/resources/documents/2021-09/SDG%205a1%20in%2050x2030%20final%2010.08.2021.pdf (accessed 24 December 2021).

Chigbu, U. E., Paradza, G., & Dachaga, W. (2019). Differentiations in women's land tenure experiences: Implications for women's land access and tenure security in Sub-Saharan Africa. *Land*, 8(2), 22. doi: https://doi.org/10.3390/land8020022.

Daniel, G. I. (2021). Modes of access to land, and Gender Related productivity gap in Burkina Faso – Policy brief. Retrieved from https://www.africaportal.org/publications/modes-access-land-and-gender-related-productivity-gap-burkina-faso-policy-brief/ (accessed 30 December 2021).

Djurfeldt, A. A. (2020). Gendered land rights, legal reform and social norms in the context of land fragmentation – A review of the literature for Kenya, Rwanda and Uganda. *Land Use Policy*, 90, 104305.

Dong, Q., Li, X., Yang, H., & Zhang, K. (2008). Gender inequality in rural education and poverty. *Chinese Sociology & Anthropology*, 40(4), 64–78, doi: https://doi.org/10.2753/CSA0009-4625400405.

Doss, C., & Meinzen-Dick, R. (2020). Land tenure security for women: a conceptual framework. *Land Use Policy*, 99, 105080. doi: https://doi.org/10.1016/j.landusepol.2020.105080.

Doss, C., Kovarik, C., Peterman, A., Quisumbing, A., & van den Bold, M. (2015). Gender inequalities in ownership and control of land in Africa: Myth and reality. *Agricultural Economics*, 46(3), 406–434. doi: https://doi.org/10.1111/agec.12171.

FAO (2018). Gender gap in land rights. Retrieved from https://www.fao.org/3/i8796en/I8796EN.pdf (accessed 3 January 2022).

FAO (2021). SDG indicator metadata 5.a.1. Retrieved from https://unstats.un.org/sdgs/metadata/files/Metadata-05-0a-01.pdf (accessed 18 December 2021).

Fonjong, L., Fombe, L., & Sama-Lang, I. (2013). The paradox of gender discrimination in land ownership and women's contribution to poverty reduction in anglophone Cameroon. *GeoJournal*, 78(3), 575–589. doi: https://doi.org/10.1007/s10708-012-9452-z.

IAEG-SDGs. (2021). Tier classification for global SDG indicators as of 29 march 2021. Retrieved from https://unstats.un.org/sdgs/files/Tier%20Classification%20of%20SDG%20Indicators_29%20Mar%202021_web.pdf (accessed 27 December 2021).

Kachiwanda, S. O. (2010). Gender disparity in the acquisition of literacy in Sub-Saharan Africa: The case of Malawi. *Journal of Humanities*, 22(1), 24–43. https://www.ajol.info/index.php/jh/article/view/153388

Katila, P., McDermott, C., Larson, A., Aggarwal, S., & Giessen, L. (2020). Forest tenure and the sustainable development goals – a critical view. *Forest Policy and Economics*, 120, 102294. doi: https://doi.org/10.1016/j.forpol.2020.102294.

Kieran, C., Sproule, K., Quisumbing, A. R., & Doss, C. R. (2017). Gender gaps in landownership across and within households in four Asian countries. *Land Economics*, 93(2), 342–370. doi: https://doi.org/10.3368/le.93.2.342.

Kynčlová, P., Upadhyaya, S., & Nice, T. (2020). Composite index as a measure on achieving sustainable development goal 9 (SDG-9) industry-related targets: The SDG-9 index. *Applied Energy*, 265, 114755. doi: https://doi.org/10.1016/j.apenergy.2020.114755.

Le Blance, D. (2015). Towards integration at last? The sustainable development goals as a network of targets. *Sustainable Development*, 23(3), 176–187. doi: https://doi.org/10.1002/sd.1582.

Liu, S. (2020). Interactions between industrial development and environmental protection dimensions of sustainable development goals (SDGs): Evidence from 40 countries with different income levels. *Environmental & Socio-Economic Studies*, 8(3), 60–67. doi: https://doi.org/10.2478/environ-2020-0018.

Liu, S. (2021). Child mortality and water stress under the framework of sustainable development goals (SDGs): Evidence from twenty developing countries. *Present Environment and Sustainable Development*, 15(1), 49–58. doi: https://doi.org/10.15551/pesd2021151004.

Liu, S. (2022). Social protection and gender inequality in using enabling technology: An analysis with the framework of sustainable development goals (SDGs). *Statistics, Politics and Policy*, 13(1) doi: https://doi.org/10.1515/spp-2021-0025.

Meinzen-Dick, R., Quisumbing, A., Doss, C., & Theis, S. (2019). Women's land rights as a pathway to poverty reduction: Framework and review of available evidence. *Agricultural Systems*, 172, 72–82. doi: https://doi.org/10.1016/j.agsy.2017.10.009.

Muchomba, F. M. (2017). Women's land tenure security and household human capital: Evidence from Ethiopia's land certification. *World Development*, 98, 310–324. doi: https://doi.org/10.1016/j.worlddev.2017.04.034.

Murphy, R. (2021). The gendered reflections of stayers in China's migrant sending villages. *Journal of Rural Studies*, 88, 317–325. doi: https://doi.org/10.1016/j.jrurstud.2021.08.011.

Nishimura, M., Yamano, T., & Sasaoka, Y. (2008). Impacts of the universal primary education policy on educational attainment and private costs in rural Uganda. *International Journal of Educational Development*, 28(2), 161–175. doi: https://doi.org/10.1016/j.ijedudev.2006.09.017.

Nnaji, A., Ratna, N., & Renwick, A. (2021). Gendered access to land and household food insecurity: Evidence from Nigeria. *Agricultural and Resource Economics Review*, 1–23.

Rena, R. (2005). Gender disparity in education – An Eritrean perspective. *The Global Child Journal*, 2(1), 43–49.

Santpoort, R., Steel, G., Mkandawire, A., Ntauazi, C., Faye, E. H., & Githuku, F. (2021). The land is ours: Bottom-up strategies to secure rural women's access, control and rights to land in Kenya, Mozambique, Senegal and Malawi. *Frontiers in Sustainable Food Systems*, 5, 697314. doi: https://doi.org/10.3389/fsufs.2021.697314.

Tirivayi, N., Knowles, M., & Davis, B. (2016). The interaction between social protection and agriculture: A review of evidence. *Global Food Security*, 10, 52–62. doi: https://doi.org/10.1016/j.gfs.2016.08.004.

UN (2016). The sustainable development goals report 2016. Retrieved from https://unstats.un.org/sdgs/report/2016/The%20Sustainable%20Development%20Goals%20Report%202016.pdfAccessedon December29,2021

UN (2021). SDG global database. Retrieved from https://unstats.un.org/sdgs/UNSDG/IndDatabasePage (accessed 3 January 2022).

UNESCO (2021). SDG indicator metadata 4.5.1. Retrieved from https://unstats.un.org/sdgs/metadata/files/Metadata-04-05-01.pdf (accessed 18 December 2021).

UNICEF Innocenti. (2021). School principals in highly effective schools – Who are they and which good practices do they adopt? Data must speak: Positive deviance research in Lao PDR. *Policy Brief*. Retrieved from https://www.unicef-irc.org/publications/1221-school-principals-in-highly-effective-schools-who-are-they-and-which-good-practices-do-they-adopt.html (accessed 2 January 2022).

UNICEF Innocenti. (2020). Gender-responsive age-sensitive social protection: A conceptual framework. UNICEF Office of Research | Innocenti Working Paper, WP-2020-10. Florence, Italy. Retrieved from https://www.unicef-irc.org/publications/1116-gender-responsive-age-sensitive-social-protection-a-conceptual-framework.html

World Bank (2021). World bank open data. Retrieved from https://data.worldbank.org/ (accessed 5 December 2021).

World Bank (2022). World bank country and lending groups. Retrieved from https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups (accessed 3 January 2022).

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