

A view of the transformation of Rwanda's highland through the lens of gender: a mixed-method study about unequal dependents on a mountain system and their well-being

Abstract

Transformations of a mountain system are complex. However, the actions needed for the transformations are not always recognized as being gender biased. The Rwandan highlands are undergoing a rapid environmental and social-economic transformation. The government of Rwanda is pushing an economic and social transformation agenda with neoliberal and gender-mainstreamed agricultural policies. The primary purpose of this paper is to provide a gendered focus on the environmental and socioeconomic transformation of the Rwandan highlands and the impact of the transformation on the well-being and gender equality of its inhabitants. A mixed-methods design was used that involved quantitative data from a household survey. A total of 560 households were interviewed. Additionally, 47 qualitative interviews of different stakeholders involved in the ongoing transformations were completed. This study shows that all three transformations are occurring, but social transformation, especially the implementation of the gender-mainstreamed policies and laws on household level, is happening most slowly and faces the greatest obstacles. Women contribute considerable time and labour to household wealth and well-being, but their contributions are not matched by what they gain as household member. This study highlights that even with gender equal mainstreamed policies, these ongoing environmental and social-economic transformations have not closed the gender gap. The challenge is to identify alternative pathways and to promote the merits of gender equality, especially at the grassroots level. Moreover, diversification in income-generating activities is necessary, which requires a shift away from the agricultural sector to investment into education and training. A sustainable development pathway with a focus on gender equality could provide opportunities and new possibilities for both women and men, as well as for girls and boys.

Keywords: Mountain system, Rural transformation, Gender inequality, Well-being, Rural Rwanda

Introduction

Globally, mountain systems¹² are essential for long-term sustainable development (Marquis et al. 2012). They provide goods and services, directly or indirectly, to approximately 40 percent of the world's population. Additionally, complex and fragile mountain systems secure local women's and men's livelihoods and well-being, as well as those of the lowland population (Schild and Sharma 2011). On one hand, mountain areas play a vital ecological role in the availability of global fresh water availability and climate conditions, biodiversity, and forests, as well as in the minimization of natural hazards. On the other hand, they are socioeconomically important, especially as an income source for local populations through the production of timber and as key destinations for tourists and as places of cultural diversity (Marquis et al. 2012; Price and Weingartner 2012; Food and Agricultural Organization 2011). Importantly, mountain areas are highly vulnerable to ongoing socio-economic changes, and a shift in one of these spheres has an impact on the sustainable supply of system services and on the well-being of inhabitants (Grêt-Regamey et al. 2012; Rodriguez and Bomhard 2012). Sustainable mountain development is not only needed to secure the well-being of women and men in mountain areas but also that of people in downstream communities and globally. This fact makes the sustainable development of mountain areas a global issue (Rudaz and Debarbieux 2012; Food and Agricultural Organization 2011).

The "International Year of Mountains" in 2002 was the first time that the specific needs and challenges of mountain women were pointed out, especially during the "Celebration Mountain Women" conference in Bhutan (Zimmermann 2002). The declaration released from the conference mentioned that "Without women, it is impossible to achieve sustainable development in mountain areas" (Integrated Mountain Development and Mountain Forum 2002). Women in mountain areas are often confronted with the same challenges faced by rural women in development regions. However, the steep slopes, the altitudes, harsh weather, isolation and out-migration of male spouses intensify their daily work. They play a vital role in safeguarding the mountain ecosystem and are considered actors in the implementation of sustainable mountain development (Gämperli Krauer et al. 2017; Centre for Development and Environment, 2016; Verma et al. 2014; Rudaz and Debarbieux 2012).

The good climatic and ecological conditions of African mountains are favourable compared to the surrounding lowlands. While global-level African mountains are crucial for sustainable development, most African countries do not have mountain-specific laws or policies (Albertine

¹ Millennium Ecosystem Assessment uses the term "mountain system", defined by evaluation above sea level and steepness of slopes (Millennium Ecosystem Assessment 2005). Mountain systems are extremely diverse in terms of environmental, cultural, political, social and economic settings, rendering it difficult to broadly define them or to generalize results (Rudaz and Debarbieux 2012).

² This study is part of an international research project analysing the impact of the agricultural and social transformation processes in four mountain areas of landlocked countries (see <http://www.fate.unibe.ch/>).

Rift Conservation Society 2017). The Rwandan highlands are undergoing a rapid environmental and social-economic transformation. This tropical mountain highland provides livelihood security for smallholders households in one of the highest-rural population areas in the world (Clay 2017). Additionally, because of the presence of mountain gorillas in Volcano National Park, it is the primary tourist area of this small east-central African country (Maekawa et al. 2013; Sabuhoro et al. 2017). Fertile but shallow volcanic soil, rainfall between 1,300 and 1,600 mm per year, an average temperature of 17° Celsius and sophisticated labour and land use systems create favourable conditions for agricultural production (Roose and Ndayizigiye 1997; Verdoodt and van Ranst 2003; Kagabo 2013a; Akinyemi 2017). This rain-fed production system is highly vulnerable to climate change. Frequent extreme weather events, such as floods and droughts, have occurred in the region (Bendito and Twomlow 2014). This environmental transformation impacts the economic sphere, which itself has transformed. In 2000, the government of Rwanda introduced “Vision 2020”, a neoliberal development agenda, which values most the transformation of agriculture into a productive activity with high value, of which market-oriented agriculture is the focus (GoR 2000; Ansoms et al. 2017; Cioffo et al. 2016). This agenda was expected to secure the food demands of the population and, additionally, boost economic and labour market development (GoR 2013a; GoR 2013b). Additionally, the state is pushing social transformation through gender-mainstreamed policies. Internationally, Rwanda is in a good shape regarding gender equality. According to “The Global Gender Gap Index”, Rwanda ranks fourth out of 144 countries, higher than many western European countries (WEF 2017). These facts must be reflected upon critically³ and be compared with other indices. The OECD “Social Institution and Gender Index” (2014) reported medium discrimination of social institutions against women in Rwanda (OECD 2014).

Despite this emphasis on gender equality, the work of women and men who depend on this mountain area, as well as household food production, water and energy supplies, is gendered. In fact, there is a lack of disaggregated data on women’s and men’s dependence and well-being in the northwest Rwandan Virunga mountain area (Henninger 2013; Skinner 2011). Gender norms influence the vulnerability and gains produced by environmental, social and economic changes (Detraz 2017). Women’s and men’s interactions with the environment, land use and the paid labour market are deeply rooted in perceptions of gender roles. Gender is related to the socially constructed understanding of what women and men ought to be. Gender roles structure everyday practices and intersect with power relations (Leach et al. 2016). From a feminist point of view, sustainable development goes hand in hand with the redistribution of wealth, power, paid and unpaid work and leisure time (Bidegain and Rodriguez 2016).

³ See Jerven. 2013. Poor Numbers. How We Are Misled by African Development Statistics and What to Do about It.

Additionally, distributional equality is linked to sustainability and well-being within present society and for coming generations (Anand and Sen 2000). Furthermore, “The World Happiness Report”, published by the United Nations, ranked Rwanda internationally in the bottom six countries in terms of well-being (Helliwell et al. 2018). Previously, published articles have focused on the well-being of the people in Rwanda without a focus on gender disparities (Ansoms 2007; Berry 2015; Dawson and Martin 2015; Dawson et al. 2016).

Focusing on gender roles in the rural mountain system, for instance, by analysing the time use of women and men separately is critical to the understanding of gendered dependencies and opportunities. Neglecting a gender perspective could lead to a blind spot and a lack of consideration of a part of society in this mountain system. Furthermore, viewing the system through a gender lens is necessary to develop gender-sensitive policies and a comprehensive pathway to sustainable development, as well as equal levels of well-being for men and women. Well-being as a holistic approach goes beyond economic measurement and should be discussed in the context of sustainability (Stiglitz et al. 2009).

This paper provides a holistic focus on the environmental and social-economic transformation of the northwest Virunga volcanic chain through a rich mixed-methods dataset. Household food production and water and energy sources are the entry points of the study. Natural resources must be observed in terms of land size, limited employment opportunities, climate-related events and a gendered division of labour. The purpose of this paper is to examine how gender shapes dependence on the mountain system, and it questions whether these ongoing environmental and social-economical transformations influence the well-being of women and men and contribute to gender equality. Additionally, the paper elaborates whether the gender-mainstreamed policies and laws have trickled down to women’s and men’s daily lives. The analysis adds to sustainability debates on mountain areas from the perspective of gender equality. This study is limited to the mountain highlands of Rwanda but could be transferred to other mountain regions.

The Northern Province as a part of the Rwandan Virunga mountain system

The northwest Virunga volcanic chain is part of the Albertine rift and borders the Democratic Republic of Congo and Uganda. In the Virunga National Park a 160 km² protected area, the presence of mountain gorillas and the associated revenue from tourism play major roles in the conservation of the park. Forest overgrowth modulates the infiltration and release of water. Thus, the forest is crucial for the surrounding population, securing their livelihoods, primarily through small-scale agricultural production on extremely steep slopes and soil predisposed to erosion (Byers 1991; Munanura et al. 2016; Sabuhoro et al. 2017). This mountain system is part of the 1700 km² Northern Province in north-western Rwanda. The Northern Province has

a population density of 527 inhabitants per km², an annual population growth rate of 2.4 percent in 2016, and agriculture at the centre of its economy (GoR 2015; World Bank 2017a; Ansoms et al. 2017). The elevation of the Northern Province ranges from 1700 m above sea level in the Gakanke district to 4500 m above sea level on the Karisimbi volcano. Natural and anthropogenic drivers of change influence the mountain system. Land is a limited resource in Rwanda, and the average land share per household decreased from 1.2 hectares (ha) in 1980 (Jayne et al. 2014) to 0.7 ha in 2006 (Ansoms and Rostagno 2012; UNCTAD 2014) and then to 0.59 ha per household in 2013 (GoR 2013a). According to Holden and Otsuka (2014), it is difficult to secure a livelihood from a landholding smaller than 0.25 to 0.5 ha. Policymakers and scientists have discussed the topics of land or environment sustainability and population growth for decades, often in a simplistic or deterministic way. A gendered approach opens the topic to a more holistic approach, in which population numbers are understood in the context of complex social, economic and political processes (Detraz 2017; Dawson et al. 2016). The processes of deforestation, soil degradation and climate change affect the Northern Province. Previously, Messerli et al. (1990) and Roose and Ndayizigiye (1997) asserted that erosion, soil runoff and degradation on the steep cultivated slopes were dire. Since then, the government of Rwanda has paid significant attention to soil conservation, and terraces have been slowly built to reduce soil erosion. However, the recent literature has reported soil loss through intensive farming on steep slopes, especially in the northern highlands (Kagabo et al. 2013b). Furthermore, African ecosystems are previously affected by climate change, especially in equatorial Africa. This trend is leading to increased uncertainty regarding rainfall and unpredictable weather extremes, such as floods and droughts, which have recently increased (Bendito and Twomlow 2014).

Rwanda's economic transformation

The government of Rwanda is focusing on the transformation of agriculture from primarily subsistence-oriented to market-oriented production. The Crop Intensification Program (CIP) is a primary part of the "Strategic Plan for Transformation of Agriculture" and is in line with Rwanda's "Vision 2020" development programme. Through this commercialization of agriculture, new employment opportunities inside and outside of the sector are expected to be created (GoR 2000; GoR 2013a; GoR 2013b). However, the political efforts of the Rwandan government aim not only to scale up agricultural production but also to integrate into the export market, this has achieved varying results (Booth and Golooba-Mutebi 2012). Rwanda wants to be attractive to investors, and according to the World Bank "Doing Business Report" (World Bank 2017b), Rwanda is ranked second in Africa in ease of doing business. Over the last

decade, Rwanda has implemented 47 business-friendly reforms in line with Vision 2020 (World Bank 2017b).

The CIP focuses on the rapid growth of the agricultural sector through intensification and commercialization of agricultural production. The primary elements of the policy are land consolidation, use of fertilizer and quality seeds, a shift from mixed-cropping to mono-cropping and a focus on the selection of crops and the development of cooperatives (Huggins 2014; Clay 2017; GoR 2012). One core objective of CIP was to create macro-zones for selected crops (priority crops) to scale up the agriculture. It is expected from the government that farmers follow its guides (Harrison 2015). The study by Huggins (2014) showed that Rwandan agricultural policies were implemented rapidly without a long testing phase, especially the part regarding priority crops, in order to fasten food and income security for rural dwellers. The government works through cooperatives to reach villagers in rural areas, and cooperative members benefit from subsidized inputs and trainings (Ansoms et al. 2017; Tobias et al. 2013; Verhofstadt and Maertens 2014). Huggins (2014) pointed out, that cooperatives, in many developing countries are used as vehicles to reach smallholders producers. However, cooperatives are also seen as the government's long arm, and only farmers that are members have higher access on given subsidies and training programme. Cioffo and Ansoms (2016b) and Mann and Berry (2016) argued that these technocratic policies exist to reshape the rural setting to foster economic growth, as well as to reinforce state authority and to gain a greater degree of control over implementing of development programmes in rural settings. Mann and Berry (2016) argued that the government of Rwanda has deepened state power and expanded its political control over the current development approach in order to achieve its development goals. According to Pritchard (2013) and van Damme et al. (2014) this may cause a trade-off between subsistence farmers choices and innovation potential vis a vis higher production and productivity of the prioritized crops.

According to Cioffo, Ansoms and Murison (2016a), the increase in agricultural production that followed the CIP seems to have benefited farmers with medium and large landholding. disparities and the programme risks to negatively impacts on soil fertility, biodiversity and on social sustainability. Huggins (2014) asserted that the vulnerability of small-scale farmers has increased, especially due to greater dependence on market forces. Purchasing agricultural inputs is only possible if households have money remaining for investments (Cioffo et al. 2016). Farmers with very small plots and landless, especially young farmers, are pushed out of agriculture and into the paid labour market, and they are constrained to work for those with relatively larger land or in agribusiness to secure their livelihoods. The people who depend on casual agricultural work are the poorest people within rural society and their number has been recently increasing (Rizzo 2011; Ansoms and Claessens 2011). To foster non-agricultural employment, the government of Rwanda implemented in 1996 the 'Imidugudu' policy. To reach

the goal of a diverse economy, scattered rural homesteads were regrouped into donor- or government-constructed villages. This program has little effect in terms of diversification and creation of non-farm employment, when households in the 'Imidugudu' were compared to other rural households (Isaksson 2013). Additionally, wage employment in rural areas is limited, especially for women. More than sixty percent of the labour force is affected by labour underutilization, indicating that there are more job seekers than employment opportunities (GoR 2016). Notably, women are overrepresented in such low-paid jobs (Razavi et al. 2012). According to Dewaso (2015), access to work and land is an important factor of well-being for the rural population of southwest Rwanda. Additionally, health, household economic circumstances and freedom of choice influence life satisfaction (Dewaso 2015).

The topic of women in agriculture has been discussed over the last few years critically. According to Ingabire et al. (2018) and Bigler et al. (2017), the farming system has remained predominantly at the subsistence level, and the number of farms has increased over the past decade. Furthermore, the feminization of subsistence farming is visible in Rwanda, and women's access to more commercialized agricultural production is more limited than men's. Three components were identified as hindering women's integration into market-oriented agricultural production. First, women still have poor access to markets and agricultural inputs (e.g., fertilizer, seeds). Second, women have limited control over agricultural income. Third, women carry the double work burden of productive and reproductive work on their shoulders (Ingabire et al. 2018; Bigler et al. 2017).

Rwanda's social transformation

In addition to aiming for an economic transformation, the post-genocide government has pushed for a social transformation through women-friendly policies and has placed gender equality at the core of its new development strategy (Burnet 2011). Equal rights for women and men are specified in the 1999 inheritance law, 2003 constitution, 2009 labour law, 2013 law governing land and 2016 governing matrimonial regimes, donations and successions law (GoR 1999; GoR 2003; GoR 2009; GoR 2013b; GoR 2013c; GoR 2017). All of these laws are important for women in the agricultural sector (GoR 2017). The question that arises here is how these policies and laws are implemented and whether they lead to a real change at the grassroots level – the question of the 'implementation gap'. The connection between policy and practice has been discussed by different researchers, policy analysts and policymakers and for different geographical regions (Abubakari et al. 2018). North (1990) shed light on the discussion of social changes in societies through laws and policies with his theoretical approach of "formal and informal institutional change". Changes to formal institutions (laws and policies) can occur quickly through political or judicial decisions. Changes to informal institutions (customs, traditions and codes of conduct) are slow moving compared to formal

institutions because they are a part of culture and connect the past with the present and future (North 1990). Additionally, Bergen (2004) showed that the link between policies and practices is diffuse and is not always straightforward. .

The new Rwandan constitution introduced a gender quota for all decision-making organs, from the grassroots to the national level, and it brought a countable change. Rwanda was the first country with a majority-female legislative body. However as highlighted in Burnet (2011), the implementation of the legislative gender quotas has more benefited women in urban than those in rural areas. Taking the case study of women in decision-making positions including those in the parliament, she discussed how urban women have economically gained while those in rural areas whose main occupation is farming have seen their workload increasing (Burnet 2011). Furthermore, under the law, women have the same rights to own and inherit land as men; this law is progressive compared to those in other African countries (Cooper and Bird 2012). According to National Institute of Statistics of Rwanda (NISR) (2015), 54 percent of land holdings are shared ownerships between husbands and spouses. Abbott, Mugisha and Sapsford (2018) pointed out that women and men in Rwanda have basic knowledge of the land and inheritance law and whether they can claim them. However, only women who have registered as being in a monogamous relationship have been recorded as holders of land titles. For women without legal marriage documents, access to land is precarious (Ali et al. 2014; Santos et al. 2014). Additionally, women in unofficial marriages face the same obstacles, since their land rights are not registered (Cooper and Bird 2012). The implementation of the inheritance law has been a challenge, especially in cases of women asserting their rights to land. Major social obstacles exist: parents resist allowing their daughters to inherit land due to the expectation that daughters will play subordinate roles in the household and due to the existence of unofficial marriages (Polavarapu 2014). Polavarapu (2014) argued that the bases for the gender equality obstacle in Rwanda are land scarcity, vestiges of discriminatory legal systems and gender-biased power relations. In addition, Ali (2014) demonstrated comparable results of the land tenure regulation and women's access to land: this regulation stands in competition with the informal practices of land inheritance and land ownership and runs counter to the traditional concept of equality. This fact leads to the effect that daughters cannot profit from new relations. A positive outcome of the land law is that of tenure security. Landowners, especially female-headed households, now invest more in soil conservation. Similar results were found in Ethiopia, where the land registration process has had a positive effect on women's land tenure security (Kumar and Quisumbing 2015). Furthermore, women's legal access to land does not guarantee their ability to make decisions regarding the land (Abbott et al. 2018; Bayisenge et al. 2014). Additionally, Abbott, Mugisha and Sapsford (2018) showed in their study that not only do daughters have a subordinated role in Rwandan society, but women do also.

However, previous studies have shown that the implemented social transformation, despite formal institutional changes in Rwanda, has not fully reached the grassroots level and that women's decision making over their own lives remains very limited (Abbott and Malunda 2016).

Sustainable mountain system development with a gender perspective

The Brundtland Report (1987) presented the widely accepted three pillar (economic, social and environment) concept of sustainability. However, the report did not focus on intra-generational and gender equality (Leach et al. 2016). Detraz (2017) described several reasons to use a gendered sustainability approach, the most important of which are as follows: first, viewing sustainability through the lens of gender raises important questions and broadens the sphere of analysis; second, such an approach shows specifically gendered manifestations of injustice; and third, the approach should aid in developing a more holistic understanding of global environmental problems and responses to them using gender-sensitive policies. Sachs (1999) argued that there is increasing evidence of synergies among the three spheres of sustainability and gender equality. Leach et al. (2016) discussed the intersection of sustainable development and gender equality and defined sustainable development as “development that ensures human well-being, ecological integrity, gender equality and social justice, now and in the future” (Leach et al. 2016: 6). This paper rooted its analysis in this definition of sustainable development. Schleicher et al. (2017) and Tuula and Hirvilammi (2015) found a close link between sustainable development and human well-being. They argued that well-being is at the core of sustainable development and the primary goal for societies. Additionally, both papers focused on the relationship between ecosystems and well-being (Schleicher et al. 2017; Tuula and Hirvilammi 2015). Furthermore, there is a long tradition of debating the relationship between gender equality and the environment or ecosystem. The link between the two is problematic, especially when using simplistic and deterministic associations between women and nature. The focus must be on observing environmental, social and economic transformations through the lens of power, facilitating a much broader understanding of gender equality than that found in former publications (MacGregor 2017). The focus on power relations and gender equality opens the debate to a deeper discussion of these transformations and the identification of an adequate solution for a sustainable pathway (Sturegon 2017).

A substantial number of studies have applied a gender perspective on mountain systems, mostly with a local scope and with very diverse core areas; among these studies is Viazzo (1989), which discussed women in the Alps with a focus on gendered division of labour, and Hamilton and Halvorson (2007), regarding women in the aftermath of earthquakes in the Kashmir region. Few studies have discussed “mountain women” from a broader view; among these studies are Byers and Sainju (1994), which focused on women in ecosystem conservation, and (Rudaz and Debarbieux 2012), which debated the term “mountain women”.

Contemporary with the 2002 “Celebration Women Conference”, in 2014, the *Journal of Mountain Research and Development* published a special issue on women and men in mountain areas (Verma et al. 2014; Anand et al. 2002; Anand and Josse 2002). The 2014 issue discussed gender and sustainable mountain development in different mountain systems. However, the geographical focus on African mountain systems was not included; therefore, this discussion will be continued in and supplemented by this article. This study also applies a gendered perspective using women and men as its primary analytical categories and analyses whether the ongoing environmental and socio-economic transformation contributes to gender equality and well-being in this mountain area.

Conducting fieldwork

For this study, expanded fieldwork was conducted over two years, making it possible to use a large dataset and build trustful and stable relationships with different stakeholders. Any scientific activity that involves the participation of women, men and children requires reflection upon the potential impact of the research on all of those involved (Calder 2014). To insure this outcome, the anonymity of the respondents is safeguarded during the whole research process. Furthermore, trustful relationships are needed so that the respondents have the freedom of speaking and have the ability to step outside the usual biases or prejudices or even answering questions based on what is considered acceptable answer by researchers or the community (Chakravarty 2012; Fujii 2010). However, not only trust is needed but also reflection in a more general way regarding how data are gathered. The research team chose its research assistants and translators carefully. The research assistants were trained extensively, paying particular attention to collecting and metadata, such as rumours, inventions, denials, evasions and silences (Edwards 2013; Fujii 2010).

Methodological approach

An Explanatory Sequential Mixed-Methods-Design (Creswell 2014) was used that involved quantitative data from a household survey and qualitative data from individual interviews and focus groups discussions.

Before the data collection, the Ministry of Education approved the research process, including the questionnaire, and it assigned the research a clearance certificate by the National Council of Science and Technology (NCST). Prior to individual interviews, the aims of the research were also explained to respondents who had free consent to participate in the study. The research area was the Northern Province of Rwanda. This province was chosen according to its economic diversity (tourism, market and subsistence-oriented agricultural production),

agricultural potential, closeness to borders and the presence of the Virunga mountain system. These factors together make the Northern Province unique for Rwanda, compared to lowland provinces with less rainfall, such as the Eastern Province. Additionally, in the Northern Province, the unemployment rate increased over the previous year (GoR 2018). This study is part of an international research project on the impact of agricultural and social transformation processes in mountain areas in four landlocked countries⁴.

To gather the quantitative data, a multi-stage sampling technique was used. The technique was implemented as follows. Three districts out of five in the Northern Province of Rwanda -- Burera, Musanze, Gakenke -- three sectors from each district, and two cells from each sector were selected purposefully. The districts and cells were chosen based on the level of agricultural commercializing and their geographical advantage of being close to either important local markets or to the Ugandan border. In the final stage, two to three villages from each cell were randomly selected. The sampling frame was derived from the names of the households at the village leadership level. Data collection was performed using face-to-face interviews, separate from other family members. All respondents provided informed consent and were interviewed in most cases by an enumerator of the same gender.

A total of fourteen gender equal enumerators and two supervisors (team leaders) were trained to understand the questionnaire in detail. The questionnaire was in English and later was translated into Kinyarwanda. The quality of translation was assured through two person integrity. The questionnaire was developed by an international research team, together with local partners, and was guided by the results of the first qualitative data collection.

The quantitative data collection (October 2015) was conducted in two phases with a one-week interval between them. It was supervised by senior researchers. In the first phase, a tool that captured information about household demographic characteristics, such as off-farm employment, cropping activities and assets, was administered to representative household members who were knowledgeable about most aspects of the household agricultural production and employment activities. From the households interviewed in the first phase (n= 554), the main male and female decision makers were identified. Fifty-four percent of the respondents were women, and 46 percent were men. Based on the NISR (2012), Northern Rwanda has population proportions of approximately 53 percent and 47 percent, respectively. There was thus no statistically significant difference between the population and the samples used in the analyses, eliminating the need to further weight the samples. The slight differences did not affect the results realized. Based on Yamane (1967), a minimum sample of 322 respondents was needed. The sample size was increased to account for any non-responses. During the second phase, 567 women (58 percent) and men (42 percent) from the 381

⁴ See <http://www.fate.unibe.ch/>

households studied in the first phase were interviewed. During the second phase, data on well-being were obtained, as well as gender relations and time use (24 hour recall of all activities done) at the individual level. This survey-based data collection is the most often used method to conduct time-use data. This approach had some disadvantages: respondents could not recall all activities, activities could overlap, or the participants responded according to social desirability (Freedman et al. 2013; Minnen et al. 2014). To overcome these methodological weaknesses, time-use data were also collected during the qualitative interviews. These data—time-use data in particular—are needed to determine gendered roles and the distribution between productive and reproductive work. The non-response rate was less than 5 percent. To gather quantitative data about subjective well-being, the “Personal Well-being Index” was included in the survey questionnaire. This multi-item scale index allows for the determination of interviewees’ global life satisfaction and satisfaction in specific life domains (e.g., income, social relations, and health) (The International Well-being Group 2013). Additional context-relevant life satisfaction questions were added to the questionnaire. A seven point Likert-type scale was used, with responses ranging from strongly dissatisfied (1) to strongly satisfied (7) (Diener 2009; Lau et al. 2005). The quantitative data analysis was completed using a descriptive to inferential analysis. A probit model was used to identify factors influencing the overall well-being of households (Morlini et al. 2015).

The qualitative data collection was conducted in three waves, two before and one after the survey. Mapping the context was the goal of the first wave of data collection (15 individual interviews, six women and nine men) with leaders of farmers’ organizations, cooperative and agribusiness leaders, executives’ secretaries, government officials from the Rwandan Agricultural Board, Rwandan Development Board, National Agricultural Export Development Board, and Women’s Organization and members of the University of Rwanda. In the second qualitative data collection, 27 individuals (20 women and 7 men) from six different employment groups were interviewed: agricultural cooperatives members (5), casual agricultural labourers (5), workers from the processing industry (7), contract farmers (4), subsistence-oriented farmers (4) and domestic workers (2). The goal of these data collection was to gain information about the division of labour, decision making at the household level, care work, well-being and asset building. In the seven focus group discussions (4 women only groups and 3 men only groups) held after the survey focused on access to land. All of the interview guidelines were semi-structured, and the interviews were transcribed and translated from Kinyarwanda to English (when necessary) and then coded and categorized based on grounded theory. In particular, one reason that led to the choice of grounded theory as a basis for the qualitative analysis, is the inductive approach, which affords the possibility of breaking the researcher’s presumptions and opening a space for new representation of women’s and men’s realities. For this study, this methodical approach fitted very well, especially for discovering social norms

and intra-household decision making (Strauss and Corbin 1996). As a final step, the evidence from the qualitative and quantitative results were analysed and interpreted together for a deeper understanding of the data. This mixed-method approach offsets the weaknesses of both qualitative and quantitative research. Additionally, it enables multiple perspectives, which are needed to fully capture all the dimensions of gendered socioeconomic and environmental transformation of the studied mountain system and its impact on the well-being of women and men (Creswell and Plano 2011).

Women's and men's dependence on the mountain system and their well-being

The first part of the results section explains the three transformations in the studied mountain system. The entry points are household food production and land, water and energy. The second part of the results section details how women and men described their well-being and the factors that improved their life satisfaction. The quantitative and qualitative results interweave, and qualitative quotations of interviewees are used to confirm the quantitative findings.

Distribution of productive and reproductive work and the links to water and energy

The drivers of the agricultural transformation are individual commercialized farmers, agribusiness and market-oriented cooperatives. In the three districts studied, 65 percent of the households are self-employed farmers. Asked about their primary employment, more women than men (60:40 percent ratio) generate most of their livelihoods through small-scale farming. Women and men spend nearly the same amount of time per day working in their own fields. However, men are more involved in income-generating activities outside their own farms and invest more time in their own businesses. If women work outside their own farms, they mostly perform casual agricultural labour. Fifteen percent of the respondents secure their livelihood with casual agricultural work as a primary source of income, and more women than men (60:40 percent ratio) have this type of employment. Commercialized farmers, agribusinesses and market-oriented cooperatives employ casual agricultural workers, primarily on a daily basis. Sometimes, these businesses employ the same workers over an entire season. In the qualitative interviews, most of the employers clearly indicated that they pay 1000 Rwandan francs (RWF) per day (1 US\$ = 840 RWF), and several provide additional food. Our survey data showed a lower daily wage and a larger actual gender wage gap per day for on-field casual agricultural workers (n=341). The average daily salary of an on-field casual agricultural worker is 800 RWF (SD 208). Women earn an average of 730 RWF (SD 138) per day, and men earn 900 RWF (SD 244), indicating that for the same work, women earn 23 percent less

than men. For women, it is difficult to shift childcare duties to other family members or institutions. Therefore, they usually bring their youngest children to the workplace, which reduces their daily salary, providing one explanation for the gender wage gap. Furthermore, the wages of casual agricultural workers are the lowest in the rural labour market. The following quotation comes from a qualitative interview with Marc, a casual agricultural worker:

“My life depends on this job every day. It is very important to me; with this 1,000 RWF, I can buy food, but the money is not enough. At the moment, one kilo of beans costs 500 RWF, and imagine working for two kilograms of beans, with a family of seven people—you see, this is very little money.” – Marc, casual agricultural worker, Kinigi.

Casual agricultural work is a poverty trap. The low wages of casual agricultural work cover basic needs but are not sufficient for asset building. Moreover, the qualitative data show that more men than women are involved in the agro-processing industry or perform non-agricultural labour, for which salaries are higher than in the agricultural sector. As shown in Table 1, women work approximately four hours per day performing income-generating activities and four and a half hours in reproductive work. Per day, men spend one hour and 40 minutes more than women on income-generating activities and nearly three hours less than women on reproductive work. Moreover, men have more leisure time and time for social activities than women. As a result, men have more time than women to recover from their daily duties and to maintain their social networks.

Table 1. Time use. Mean hours spent on daily activities for women and men

<i>Activity</i>	<i>Women</i>	<i>Men</i>
	<i>Mean hours per day</i>	<i>Mean hours per day</i>
<i>Farming and livestock keeping</i>	2.71	2.88
<i>Own business work</i>	0.43	1.30
<i>Paid employment</i>	0.80	1.51
<i>Total hours on productive activities</i>	3.94	5.69
<i>Caring for children/adults/elderly</i>	1.29	0.74
<i>Domestic work (incl. fetching wood and water)</i>	1.17	0.36
<i>Cooking</i>	1.40	0.13
<i>Shopping/obtaining services</i>	0.42	0.17
<i>Weaving, sewing, textile care</i>	0.11	0.03
<i>Total hours spent on reproductive activities</i>	4.39	1.43
<i>Leisure time</i>	0.28	0.86
<i>Social activities</i>	1.22	1.55

The data show that childcare and other domestic work, including collecting firewood and water, are women's responsibilities. If there are children in the household, women might shift responsibility for the supply of energy and water to them. The following quote is from Zelda, who described how her family uses its time and how her husband is involved in maintenance of the household energy supply:

"We go to the field together; when we come back, he cuts firewood for me. The children help in the rest. He goes to the bar and comes back in the evening." – Zelda, farmer, Kigote

This quote shows the responsibilities and power relations of women and men at the household level. They share the daily fieldwork, but domestic work and leisure time are clearly separated.

Furthermore, the primary source of energy is firewood. Ninety-two percent of households (n=551) use firewood as their primary source of energy for cooking, and 8 percent use charcoal. Over the previous five years, the number of households using firewood remained stable. However, there was a change in lighting sources over the previous five years. The use of electricity and torches increased from 14 percent (n=80) to 27 percent (n=148), and from 34 percent (188) to 46 percent (n=252) of households used them as a primary source of lighting. Over the same period, the use of kerosene lamps, candles and firewood as source of lighting decreased.

Collecting water is also a gendered task. Seventy-four percent of households (i.e., women) require less than 15 minutes to collect water, 16 percent need between 15 and 30 minutes, and 10 percent require more than 30 minutes.

Shifting the duty of water collection or cooking from women to men is a not socially accepted behaviour. One male respondent explained:

"We can do it, but we are afraid of being seen by our neighbours; they may think that we suffer or that we have been poisoned by our wives." – Jean, farmer, Kinigi

In summary, the distribution of productive and reproductive work is not equally shared between women and men. Therefore, the total hours worked per day are greater for women than for men. Additionally, due to their childcare and domestic work responsibilities, the participation of women in the paid labour market is limited. Maintaining the household energy and water supply and performing other reproductive work are time consuming and can rarely be shifted to other family members due to gender norms. Rwanda has positive gender policies at the national level, but these policies are yet to be fully at community and household levels. At the grassroots level, there is different picture of gender equality. The roles of women and men are constructed differently in Rwanda's highlands, resulting in an unequal, gendered division of labour and a greater dependency of women on the mountain system.

The mountain system and the link to food production

The major challenges to sufficient food production in the mountain system are limited access to land and agricultural inputs (seeds and fertilizer), as well as erosion and climate variations. The average household owns 0.4 ha of land. Respondents who primarily depend on casual agricultural work own an average of 0.1 ha and are nearly landless. From the qualitative interviews and focus group discussions, it is clear that landholdings per household decreased in recent years and that the respondents have no land to pass to their children. If there is any land owned, the male children usually inherit it. Adele and Marie explained:

“Yes, it is among the major problems because if you cultivate and do not even get enough for home consumption, does that not show you that the land size has decreased?” – Adele, farmer, Cyanika

“Parents, too, have nothing; maybe what was given to them was a small plot on which to build a house but not enough land for cultivation.” – Marie, farmer, Kabarima

Furthermore, 86 percent of the respondents have registered their land in accordance with the new law. In over 76 percent of households women and men share land ownership, in 12 percent of households only the male spouse own land and in 7 percent the land belongs to the female spouse. In 5 percent of the households all family members or other female household members own the land. Although women have legal access to land, their decision-making power over land and agricultural production remains limited. The market orientation of these smallholders remains at a low level; only 25 percent of households are commercialized, indicating that this proportion of self-employed farmers sell half or more of their harvests. The primary crops are potatoes, beans and maize. Potatoes are the primary cash crop. Women manage 79 percent of potato production. However, they are involved in only 58 percent of the labour needed to sell the harvest. Odette shared her experience related to access to and decision making regarding the primary cash crop:

“When a man sells the whole harvest, he tells the woman to go to the field to look for the leftovers, and whatever she gets becomes her property.” – Odette, farmer, Kinigi

Regarding beans, a crop that is viewed as a female crop, women's involvement in the production and sales processes is greater than that for other crops; however, their decision-making power over bean crops remains limited, and the money that they earn is primarily used for household food security. From the same focus group, Yvonne shared her experience selling beans:

“The husband asks for the money when women sell the beans, but she sells some and saves others because she has to feed the kids.” – Yvonne, farmer, Kinigi

The use of fertilizer and so-called improved seeds has increased since the implementation of the new agricultural policies (CIP). The implementation of CIP started in 2007. Ten years ago, 75 households from the study sample (n=554) began using chemical fertilizers, and 8 households planted improved seeds. By 2015, 310 households were using chemical fertilizer, and 88 households planted improved seeds. Nevertheless, limited access to inputs and quality seeds is a constraint on the farmers in this region. The use of chemical fertilizer has improved crop output. However, many farmers noted that soil fertility has decreased over the last decade and that they do not own fallow land. Rachel and Leonard explained their experiences:

“Potatoes are no longer giving a good yield, the soil has become infertile, we no longer have adapted seeds, and this is not related only to potatoes but also to maize and beans.” – Rachel, farmer, Kigote

“The last time we skipped seasons was in 1985; I think if we could skip seasons, our harvest would increase.” – Leonard, farmer, Kanaba

Farmers described problems with soil erosion, bad weather conditions or changing weather patterns. Theo described his circumstances as follows:

“It is just like 10 years ago, before erosion washed our soil, people used to cultivate, and you would not find any problem, even without fertilizers.” – Theo, farmer, Mugandu

The survey respondents were asked about events that had affected them negatively over the previous 12 months. The households were primarily affected by health problems or the death of a household member (45 percent), followed by environmental events (31 percent), loss of livestock and unemployment (3 percent). These data were confirmed by the qualitative interviews; the farmers reported heavy rainstorms, hailstorms and droughts. All of these factors led to lower agricultural production and to food and livelihood insecurity, especially for the coming generation. Louis expressed his concern for the future of his children arising from reduced land sizes as children inherit from their parents:

“We are all going to die. I am getting older, and I will die before the children, but after me, they will suffer a lot.” – Louis, farmer, Cyanika

To conclude, securing household food security in Rwanda's mountain system is becoming more difficult, especially for coming generations. Women have less decision-making power over land, agricultural production and cash income, and they depend more on subsistence food production or casual agricultural work. This unsustainable development makes the future uncertain for women and the coming generation.

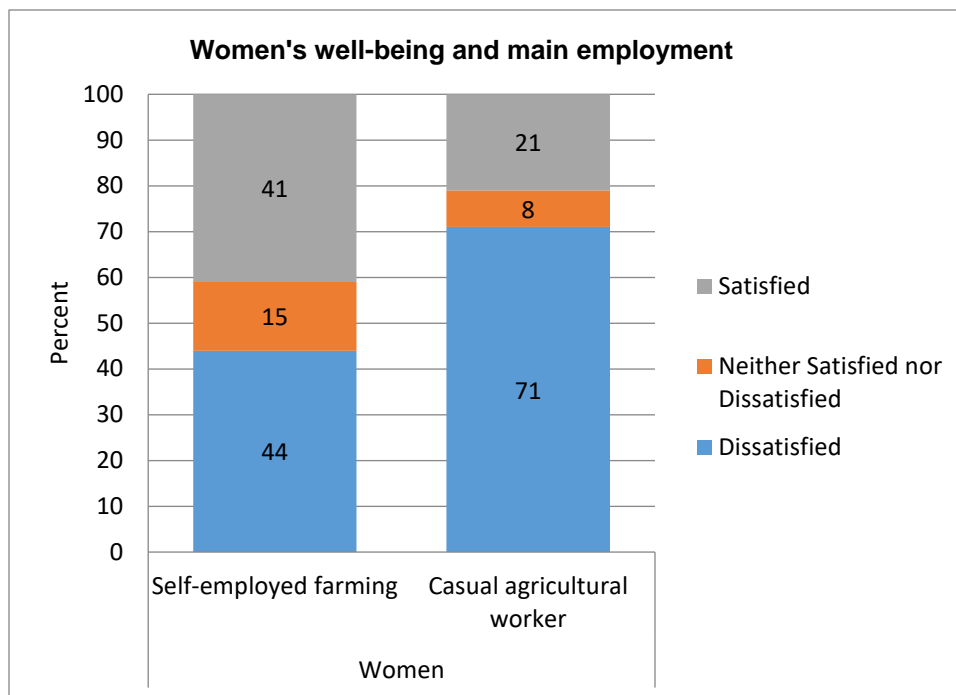
The transformation processes and their influence on well-being

As shown above, the ongoing socioeconomic and environmental transformation in this region has influence on the well-being of women and men. In the qualitative interviews, interviewees were asked about their definition of well-being. The definitions given by women and men were congruent. At the core of their definitions was the ability to meet their basic needs, their health and access to health facilities and political security. Marie-Louise shared her definition of well-being in a qualitative interview:

“When I hear about well-being, for me, it is when I am not sick, when my children can go to school with notebooks, when I can feed them and when we have shelter”. – Marie-Louise, casual agricultural worker, Kinigi

The respondents rated their global life satisfaction and their satisfaction with different life spheres. The respondents (n=567) were, on average, slightly dissatisfied or neither satisfied nor dissatisfied (men=3.6; women=3.7) with their life as a whole. The respondents were, on average, satisfied (men=6.0; women=5.8) with their personal relationships or slightly dissatisfied (men=3.3; women=3.4) with their current incomes. A difference was found in the satisfaction levels of women regarding their primary employment (Figure 1). As observed above, casual agricultural workers and self-employed farmers are feminized employment groups. Women who perform casual agricultural work (n=61) as their primary employment are less satisfied than women who are primarily self-employed farmers (n=214). Seventy-one percent of female casual agricultural workers were dissatisfied with their lives as a whole, 8 percent were neither satisfied nor were dissatisfied, and only 21 percent satisfied. Of female self-employed farmers, 44 percent were dissatisfied, 15 percent were neither satisfied nor dissatisfied, and 41 percent were satisfied with their lives as a whole, indicating that a person's primary employment has an impact on well-being, especially for women. Women performing casual agricultural work are primarily dissatisfied with their lives as a whole.

Figure 1. Women's main employment and well-being



Members of cooperatives and those with bigger land size reported that their well-being has improved with the ongoing agricultural transformation and with the increased market-oriented production. Judith, a 45-year-old cooperative member who produces crops on one hectare of land, said:

“To be in a cooperative plays a great role in my well-being. There is a difference: Before I worked for the cooperative, and now I belong to the cooperative.” – Judith, farmer, Gahunga

The distribution of and access to land have impacts on the subjective well-being of small-scale farmers. Respondents with little land (less than 0.2 ha) are strongly dissatisfied with their lives when considering their lives and personal conditions. This finding is the opposite of that for farmers who own a medium amount of land or an amount of land greater than 0.4 ha, who are either satisfied or strongly satisfied. No gender difference was found with respect to satisfaction level. Respondents with limited access to land are pushed out of self-employed farming into casual agricultural work. Gregory, a casual agricultural worker, is content to earn a wage from seasonal employment because his own field is too small to cover the food needs of his family:

“Well-being, how I see it, comes from this job. Before I had no food to feed my kids, but since I have this wage work, my well-being has increased.” – Gregory, casual agricultural worker, Kinigi

Based on the qualitative results regarding well-being, especially regarding the definition of well-being, an inferential analysis was performed. The data were analysed to identify factors that influence subjective well-being (Table 2). The data show that among the various explanatory

variables, land size, age, gender, access to the market and food security, two variables were significant. There was a statistically significant, positive relationship between subjective well-being and land size and a statistically significant, negative relationship between subjective well-being and food insecurity. The more land that someone owns, the more likely that it is that the person is satisfied with his or her life as a whole. The less that a person worries about food security, the more satisfied that the person is. Additionally, the respondents (n=567) were, on average, slightly dissatisfied to neither satisfied nor dissatisfied (3.8) with the availability of food.

Variable		dy/dx	Std. Err.	P>z	95% Conf.
Land size		0.225	0.071	0.001	0.0862
Age categories	31-40	-0.002	0.091	0.986	-0.1793
	41-50	0.004	0.096	0.970	-0.1855
	51-60	-0.040	0.108	0.712	-0.2508
	61-99	-0.143	0.104	0.170	-0.3467
Gender	Male	0.078	0.075	0.299	-0.0691
Means to nearest market	By vehicle (paid bus)	0.035	0.151	0.816	-0.2608
Health insurance		0.171	0.093	0.065	-0.0105
Food security		-0.152	0.068	0.026	-0.2854

The results reinforce the qualitative result that access to and the productivity of land influence well-being.

female casual agricultural workers are dissatisfied with their lives. Access to land and food security are needed to increase the well-being of women and men in this mountain area.

Discussion

The primary purpose of this paper was to provide a gendered focus on the environmental and socioeconomic transformation of the Rwandan highlands and the impact of the transformation on the well-being and gender equality of its inhabitants. The theoretical background was the sustainability debate from a gender perspective. This study shows that all three transformations are occurring, but social transformation, especially the implementation of the gender-mainstreamed policies and laws on household level, is happening most slowly and faces a good number of obstacles.

According to Sturegon (2017), environmental changes must be analysed through existing power relations, which is also the case for Rwanda. The study shows that this rural area is affected by climate change, which is an external factor with an impact on local livelihoods and food security, and the local population is forced to adapt to new environmental circumstances (Intergovernmental Panel on Climate Change 2014). According to Kagabo (2013a), the intensification of agricultural production on steep slopes has increased erosion and decreased soil fertility. The results of this study also show that there is uncertainty regarding food production, even with the implementation of improved seeds and fertilizer. Women are primarily in charge of household food security and stable food production. The environmental transformation has a direct impact on women's lives (Doss 2002).

At the same time, with the ecological transformation, an economic state-driven transformation occurs. The implementation of the agricultural policies, such as the "Crop Intensification Program", has brought positive outcomes but not for the entire rural population. Cioffo et al. (2016) and Lund (2016) discussed the importance of these new agricultural policies and argued that the programmes have a negative impact, especially on poorer farmers with more limited access to land and inputs. They do not benefit as much as would medium or higher income farmers with larger farms. Harrison (2015) demonstrated that the macro-zones for selected crops and the 'Imidugudu' policy are not competed and that a transformation of agriculture is a matter of decades, not years. Additionally, Huggins (2015) paid attention to the top-down agricultural policy implementation of the government of Rwanda and concluded that more flexibility in the implementation, more actions in some areas and fewer in others would have a positive impact. At the moment, the scope of action for people on the ground is limited (Ingelaere 2014), and innovation and knowledge from below are not captured (van Damme et al. 2014).

The study shows that the agricultural transformation goes hand in hand with low-income casual agricultural work. Ansoms et al. (2017) and Ansoms and Claessen (2011) demonstrated that

farmers with poor access to land risk leaving the primary sector to depend on limited employment opportunities in rural areas. In the case of the Rwandan highlands, women are overrepresented in low-income casual agricultural work. At this point, it must be recognized that women still perform the bulk of unpaid and reproductive labour, and this fact affects their employability and results in a gendered paid labour market (Razavi et al. 2012). Debusscher and Ansoms (2013) contended that childcare is not recognized or valued by the government, and Abbott, Mugisha and Sapsford (2018) argued that women in Rwanda still play a subordinated role, leading to the conclusion that power in Rwandan society is not distributed equally between women and men.

There were almost no gender differences found between men and women regarding life satisfaction level, which is generally low. This result is in accordance with the World Value Survey (2016). A satisfaction gap for women appears if well-being is observed together with primary employment. Performing casual agricultural work has a more negative influence on the satisfaction level of women than on men. Additionally, well-being is related to access to land and food security. The two factors are linked and are important to the process of the commercialization of Rwandan agricultural production (Dawson et al. 2016). These findings lead to the conclusion that, especially female casual agricultural workers are negatively affected by this agricultural transformation.

One major finding from this study is that the gender-mainstreamed policies and law have little effect on women's and men's daily lives and that social transformation is slower than economic transformation. This result is in line with the studies by Abbott and Malunda (2016), Shirley Randell and Megan McCloskey (2014) and Debusscher and Ansoms (2013), showing that formal institutional changes do not guarantee informal institutional changes at the same pace (North 1990). In the discussion of the stickiness of social transformation, the top-down approach of policy implementation should also be considered. As discussed above for agricultural policies, gender policies have also been implemented with a strong state-led approach (Ansom's and Cioffo 2016). This can justify the slow adoption at the local level (van Damme et al. 2014; Abbott and Malunda 2016; Abbott et al. 2018).

This discussion leads to the conclusion that agricultural development in the Rwandan mountain system is not yet sustainable for everyone in the society, especially in the case of women and those with limited access to land. How this specific region differs from other regions in Rwanda or other mountain regions should be analysed in further research.

Conclusion

The environmental and socioeconomic transformation of the studied mountain area is complex and gender biased. Water, energy and food production were the entry points for this gender analysis. Women maintain household energy and water supplies and are responsible for family food security. Gender norms influence the distribution of productive and reproductive labour, and this influence is linked to the level of dependence on the mountain system, on subsistence crop production and on wage employment. The redistribution of work, power and decision-making over land and agricultural production was not found, despite government efforts to promote gender equality.

The environmental transformation has manifested a decrease in soil fertility, attributed to an absence of fallow land and either too much or too little rainfall. These problems make it more difficult to fulfil household food demands through agriculture. The continuing population growth is increasing the pressure on the mountain system, especially regarding land. Each successive generation has less access to land, and the Rwandan labour market is not yet sufficiently dynamic to create new employment opportunities for the youth.

Due to women's greater dependence on the mountain system, they are more affected by the environmental transformation. The costs of this agricultural transformation are externalized to women's unpaid work, nearly landless people and the mountain system.

Women contribute considerable time and labour to household wealth and well-being. However, their contributions are not matched by what they gain as household members. Due to the economic transformation in the studied mountain area, new employment opportunities in the rural labour market have been created. If women work outside of their farms, they primarily work as casual agricultural workers. For many women, casual agriculture work is the only employment opportunity in this rural area. This low-paid employment is a poverty trap, and women who work as casual agricultural workers are unsatisfied with their lives. To date, the ongoing socioeconomic transformation has not closed the gender gap at the local level.

This study shows gender gap between laws and practices at the local level. At the grassroots level, women do not profit from these progressive laws and gender mainstreamed policies. As shown, the redistribution of power and (care) work was not found.

The challenge is to identify alternative pathways and to promote the merits of gender equality, especially at the grassroots level. On one hand, there is a need for the enforcement of gender-related government policies, especially in the area of the gender wage gap in the informal sector like for agricultural casual workers. On the other hand, a bottom-up movement is also needed to attain gender equality. As seen, the awareness and understanding that men can

profit from a redistribution of power and care work and that only through this step sustainable development is possible must be built.

Finally, diversification in income-generating activities is necessary, which requires a shift away from the agricultural sector to investment into education and training. A sustainable development pathway with a focus on gender equality could provide opportunities and new possibilities for both women and men, as well as for girls and boys.

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