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Has Sixty Years of Tanzania's Independence Reduced Women Drudgery in Agricultural Value Chains?

[1]Makindara, J. and Mbesa, B.[2]

[1]College of Economics and Business Studies (CoEBS), Sokoine University of Agriculture
[2]College of Social Sciences and Humanities (CSSH), Sokoine University of Agriculture
Correspondence: makj@sua.ac.tz

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Abstract: *This paper presents findings of the study which assessed the gaps in time and labour savings technologies in rice, maize, and cassava values chains in Tanzania, sixty years after independence. The aim of the study is to provide information about these technologies in order to inform policy and programmes aimed to improve the existing and introduce new ones so that they can be well adopted by farming communities in the rural households. In addition, the information will be used as input for the designers and marketers of these technologies. Time and labour savings technologies are normally introduced in agricultural technologies in order to increase efficiency as well as labour productivity. This focus not only increases agricultural productivity but also plays a crucial role in releasing rural women of working age from unpaid time burdens so that they have more time for productive work and to participate in development opportunities. This study was done in Mbarali and Kilombero regions for rice value chain, in Babati for maize value chain and in Mkuranga for cassava value chain. The study areas were selected purposely based on the production history, experience, volumes of production, trading activities and the status of the value development. The research design was rapid assessment and data was collected through focus group discussion and key informant interviews. Data were analysed qualitatively and through descriptive analysis. The key findings show that there are times and labour savings technologies, which have been introduced in the crops under study at different nodes along value chain, some of which have been able to reduce women drudgery especially in the processing and transportation node of the cassava value chain. However, some of the technologies have not been well adopted by women such as the use of power tillers in maize and rice cultivation. In addition, the findings show further that some technologies cannot be afforded by the poor farmers such as the use of tractors in ploughing. Therefore, it can be concluded that an enabling environment through transformative approaches, community, household, and policy dialogues can help to transform the situation and engage men or other simple technologies instead. However, this also requires challenging cultural norms in the farming communities. In turn, this will be much more instrumental towards achieving inclusive and sustainable rural development and poverty eradication, especially sixty years after Tanzania got its independence, by introducing equitable time and labour-saving technologies which can be used by women. Hence, it can be recommended that when introducing such technologies, issues of introducing the best technology options, acceptability by women or community, women priority needs and accessibility should be taken into account.*

Keywords: *Gender, adoption, time, labour savings technology*

1.0 Introduction

1.1 Background Information

Agriculture is Tanzania's economic backbone, accounting for USD 13.9 billion (ranging from 23 to 2430% of GDP) and 67% of total employment in 2014 (URT, 2017; Wineman et al., 2020). Tanzania had about 44 million hectares of arable land in 2016, with just 33% of this amount under cultivation. Practically, between 70 to 74% of the impoverished population lives in rural regions, and almost all of them work in agriculture (Makurira et al., 2011; MAFAP, 2013; URT, 2017). Land is a critical asset in guaranteeing food security, and maize, sorghum, millet, rice, wheat, beans, cassava, potatoes, and bananas are among Tanzania's nine primary food crops. The agricultural business contributes significantly to the country's foreign exchange profits, with cash crop exports generating more than US$1 billion. Moreover, some crops such as maize, rice and cassava are considered as both food and cash crops and are normally given special attention in their promotion and development interventions.

Agricultural value chains are basically those involved in promoting and developing economic value and consumer attraction of an agricultural commodity (Sauzet, 2009). The adoption of value chain approaches in agricultural development started in 1985 when Michael Porter introduced the concept of value chain in industrial development (Kaplinsky and Morris, 2001). Later this approach was also adopted in agricultural development as well and especially in agricultural commodities which are produced for export markets. Tanzania also adopted value chain approaches in agricultural development. According to Match Maker Associates (MMA) (2012), there have been several value chain initiatives in Tanzania targeting both cash and food crops, and livestock. For the food crops, these initiatives have targeted cassava, maize, rice, horticulture, and sunflower. The main supporters and funders of these initiatives were both national (e.g., Tanzania Agriculture Research Institutes (TARI)) and international organizations (e.g., IFAD, Irish AID and USAID) and national and international Non-Governmental Organisations (NGOs) such as VECO/Rikolto, Tanzania Gatsby Trust and Technoserve just to mention a few. The focus of most of these value chain interventions were on establishing and strengthening producer groups, increasing production and productivity at farm level, supporting value adding activities including establishing processing facilities and training and in enhancing market accessibility of value-added products (MMA, 2012). However, some of these initiatives did not specifically target women in their objectives.

Gender has been a developmental issue (Lyimo-Macha, et. al., 2012) especially in developing countries such as Tanzania. This is due to existence of gender gaps in development agenda in general and in other sectors including agriculture. Some of these gender gaps which have been identified in development arena and in agriculture include lack of agricultural land, spending less time in productive activities, carrying heavier loads in unpaid domestic works, and playing greater responsibility in caring for the sick, elderly members of the community and young children who are mostly dependent on women (Makindara, 2020). In addition, gender gaps have also been experienced in accessing agricultural production resources, agricultural technologies which are compatible and reduce drudgery on women, in agricultural production as well as in accessing markets.

Time and Labour Saving Technologies (TLSTs) are tool(s) and/or equipment(s) that reduce drudgery or increase the efficiency of various farming or household activities (Bishop-Sambrook, 2003). Many labour-saving devices have been developed and are now available to the public, such as improved hand tools for harvesting cereals (scythes – or reaping hooks) and the use of wheelbarrows and single-axle tractors in transportation (Flavia, 2015). Education, time availability, physical challenges, social norms, financial and institutional constraints, patriarchy, and technology have emerged as barriers to accessing and adopting improved laboursaving technologies to women (FAO, 2015). Moreover, despite of having several initiatives trying to introduce drudgery reducing technologies for women in agriculture, still human power is considered as the key and especially in the rural areas. That is, the human muscle is by far the most important power source for smallholder farmers in Sub-Saharan Africa (SSA) more than in other parts of the developing world (Clarke and Bishop (2002). Human power provides about 65% of the power required for land preparation (Table 1) and the commonly used tool is commonly a hand hoe. Therefore, it is expected that TLSTs will also play a crucial role of relieving women from using hand hoe in agricultural production and thus reduce women's drudgery in land preparation, weeding and other nodes of the value chains where it is applied in crop production activities.

Table 1: Power sources for land preparation (% of total)

	Human Muscle power	Draught Animal power	Engine power
Sub-Saharan Africa	65	25	10
East Asia	40	40	20
South Asia	30	30	40
Latin America and Caribbean	25	25	50

Source: Clarke and Bishop, 2002.

1.2 Overview of Maize, Rice, and Cassava Production in Tanzania

Maize (Zea mays L.) is a primary principal crop which is grown in nearly all agro-ecological zones of Tanzania (USAID, 2010). Maize together with wheat and rice are the three most cultivated cereal crops worldwide (Suleiman et al., 2013). The current world production is about 10.14 billion metric tons (De Groote et al., 2013). The United States (US) is the largest patron, producing over 30% trended by China 21% and Brazil 7.9 per cent. Africa produces around 7% of the total world produce. Two-thirds of all Africa production is claimed to be originating from Eastern and Southern Africa (Verheye, 2010; FAOSTAT, 2014). In sub-Saharan Africa, (SSA) maize is the most important cereal crop and the principal food for about 1.2 billion people (IITA, 2009) but is normally produced in under one-third of the cultivated area (Blackie, 1990). Maize accounts for over 30% of the producing farmers' income and contributes about 60% of calories and 50% of protein input (Amani, 2004; IITA, 2009). Tanzania is one of the major maize producers in SSA (McCann, 2001; Barreiro-Hurle, 2012; FAOSTAT, 2014), producing on average about 5.7 tons per year. There are several TLSTs that have been introduced in maize value chain from land preparation, ploughing, planting, weeding, harvesting and in primary processing. However, how these technologies have reduced women drudgery is an issue that requires exploration. This is due to the fact that after Tanzania Independence in 1961, agricultural technology development and improvement initiatives have been implemented whereby some of them were targeting just a node, while others were targeting the whole value chain.

Rice is the world's second most produced cereal. Annual production was around 350 million tons in the early 1990s, and by the end of the century, it had risen to 410 million tons (Indiamart, 2009). Rice production is geographically concentrated in Western and Eastern Asia, which account for 90% of global production and consumption. More than half of the world's rice is supplied by China and India, which account for more than one-third of the global population. Rice production in India accounts for 20% of total production, with Brazil being the leading non-Asian producer, followed by the United States (Indiamart, 2009). After maize and cassava, rice is Tanzania's third most important food crop (NBS, 2015). The annual rice production doubled between 2001 and 2012 (due to expansion in rice cultivation areas) and now averages around 1.35 million tons per year. Smallholders currently grow the majority of rice (74% of planted area) under rain-fed conditions, while irrigated rice is 20% and large-scale production is 6%. The Tanzanian government has prioritized rice through its National Rice Development Strategy (NRDS), which aims to double rice production by 2018 in order to improve food security and provide export opportunities to neighbouring countries (FAO, 2010). Rice is almost entirely consumed by humans whereby producing households consume approximately 30% of rice on average and the remaining is sold to the domestic market. The large rice consumers in Tanzania are residing in cities led by Dar es Salaam with consumption rate of 60% (FAO, 2015). The main producing regions are Mbeya and Morogoro. Rice consumption in Tanzania has increased from 20.5 kg (in 2001) to 25.4 kg (in 2011) per person per year during the first decade of the twenty-first century (NBS, 2015). However, despite rice production increase in Tanzania, the country is both an importer and exporter of rice. The exporting countries are Burundi, Kenya, Rwanda, and Uganda (FAO, 2015). As it is for the case of maize, several TLSTs have also been introduced in rice value chain since Tanzania got its independence in 1961. These technologies were those involved in land preparation, planting, transplanting, weeding, fertilizers, and herbicides application, harvesting and in processing. However, how these technologies have reduced women drudgery in rice value chain is not well known.

Cassava is the second most important subsistence crop in Tanzania, after maize. It thrives well in semi-arid areas due to its drought tolerance. Cassava is sometimes regarded as a famine reserve when cereals fail. Tanzania produces 84% of its cassava for human consumption, with the remainder used for animal feed, brewing alcohol, and starch production. According to the 2012 Food and Agriculture Organization Corporate Statistical Database, Tanzania's cassava production is estimated to be 5.4 million tonnes (FAOSTAT, 2012). Moreover, in 2012, Tanzania was the world's 12th largest cassava producer, and Africa's 6th largest, trailing only behind Nigeria. It is claimed that cassava productivity in Tanzania is only 8t/ha. The main regions producing cassava in Tanzania include Mwanza, Mtwara, Lindi, Shinyanga, Tanga Ruvuma, Mara Kigoma, the coastal regions and Zanzibar. Since Tanzania Independence in 1961, several national and international initiatives have been involved in introducing TLST in cassava value chain. Such institutions include IITA, and Kibaha Sugar Research Institute, which was hosting root and tuber research in Tanzania. The technologies introduced include those involved in land preparation and in processing. However, as it was for the case of maize and rice, how much these technologies have reduced drudgery in women is not clearly known.

1.3 Current Women Positions in Agricultural Value Chains in Tanzania

Women farmers in sub-Saharan Africa (SSA) represent a high proportion of the working force in food production, contributing between 60-80 percent of the labour for both household consumption and for sale. Furthermore, agriculture in SSA is becoming a "feminized" sector due to men's urban migration, which is leading to changing or adoption of new roles by women. However, the adoption of these roles has not been accompanied by an increase in access to resources (inputs, credit, technology, knowledge, and markets) to enable women to cope with the work burden. In addition, low adoption of Time and Labour-saving Technologies (TLST), and other agricultural mechanization technologies by women, continues to be a major challenge contributing to low agricultural productivity below the global average and especially in developing countries due to limited use of productivity-enhancing technologies (Hella and Haug, 2013).

According to recent research, there is a trend toward the "feminization of agricultural labour," referring to the increasing proportion of women in the agricultural labour force as a result of migration and new opportunities for men (Abdelali-Martini and Dey de Pryck, 2014). As a result, women's activities tend to be time and labour-intensive, and their agricultural-related activities tend to be tied to the provision of household needs, such as cultivating vegetables and maintaining homestead gardens. As a result, the workload of women is frequently characterized by being repetitive, tedious, and time-consuming and which is sometimes an unavoidable. Furthermore, it is commonly assumed that there is a gender distribution of labour in agricultural production, with men and women assigned to different tasks. For example, ploughing with oxen is typically done by men, whereas crop weeding is mostly done by women. Today, however, this line is becoming increasingly blurred as more men leave the countryside to work in cities. As a result, even after 60 years of independence, women may constitute much more than half of the rural population in a given region, and they may find themselves performing many farming tasks in crop value chain despite of the introduced TLSTs.

As a result, if such technologies are specifically tailored to the needs of women, they can be effective; though there are significant barriers to their adoption. Furthermore, the number of women farmers feeding their households, communities, countries, and regions is also growing (Caselli-Michael, 2014). On the contrary, women's access to and control over resources and work burden is still not adequately addressed, despite ample evidence that better access for women leads to higher agricultural yields and food and nutrition security (FAO, 2011b). Thus, even after 60 years of independence, it is argued that there are no "quick fixes," such as the simple introduction and diffusion of technology with labour-saving potential.

This situation is claimed to be associated with a lack of access to and adoption of technology and is context-specific and complex (Camara et al., 2013; Twomlow et al., 2010). To effect change and achieve greater equality between men and women in terms of time availability and choice, social norms and behaviour must be targeted. As a result, labour-saving technologies and related services can help women free up their time, reduce drudgery, and improve their quality of life. This will allow them to participate more in activities of their choice, whether for domestic or monetary gain (Michael, 2014). Thus, if both men and women farmers will adopt various technological changes in crop production, productivity will increase due to the reduction of drudgery brought about by the adoption of better farm-level technologies.

However, although the role of women in agricultural production including on-farm post-production activities is well documented, several gaps such as lack of resources or ignoring women while designing agricultural technologies were found to exist even after 60 years of independence. Although several attempts have been made to introduce TLSTs that can reduce the work burden and increase women's working rate, still their promotion and practices for women's adoption have not been always successful. This is mainly because i) when trying to introduce these new technologies, women's preferences and needs are not fully considered; ii) generally, there is not an equal inclusion of women in training and access to financial support e.g. credits; iii) and/or cultural barriers that prevent women from adopting certain technologies are not well understood and taken into account. Thus, in such a situation, many agricultural tools and equipment, for example, are typically designed for men's physiques, making it more difficult for women to adopt and use them.

Furthermore, issues like daily household activities (such as fetching water and firewood, cooking), lack of training, lack of finance and after-sale services for machinery all contribute to women's poor access and use of TLST for on-farm production operations as well as post-harvest processing, preservation, and value addition activities. Therefore, all these efforts do not reduce women's drudgery in agricultural value chains. In addition, it is still unknown whether these technologies will be easily adopted by Tanzanian smallholder farmers (Graef *et al*., 2014; Kuehne *et al*., 2011; Mwinuka *et al*., 2015b), and especially by women in agricultural value chains and as to whether these technologies are truly adoptable by poor smallholder farmers in the country. This study, therefore, tried to explore the existing TLSTs and their potential for agricultural activities in the targeted community to enhance both food security and nutritional effects in the household by reducing women's drudgery sixty years after independence. Specifically, the study intended to i) provide additional information on TLST in the rice value chain in Mbarali District, Mbeya Region and Kilombero District in Morogoro Region; ii) provide additional information on TLST in the maize value chain in Kongwa District, Dodoma Region; iii) provide additional information on TLSTs in the cassava value chain in Mkuranga District, Coast Region; and iv) provide recommendations that will address the critical issues regarding the access and uptake of women farmers in terms of TLSTs in the study regions in Tanzania.

2.0 Theoretical and Empirical Review

Although this study was an explorative one, it is guided by three theories. The first one is Rogers' Diffusion of Innovation Theory (DIT). This is one of the original theories guiding research on innovation diffusion and adoption. It is the earliest theory of innovation whereby new ones were established from it. The DIT was first discussed historically in 1903 by a French sociologist Gabriel Tarde (Toews, 2003) who plotted the original S-shaped diffusion curve, followed by Ryan and Gross (1943) who introduced the adopter categories that were later used in the current theory popularized by Everett Rogers. Katz (1963) is also acknowledged for first introducing the notion of opinion leaders, and opinion followers and how the media interacts to influence these two groups. According to Damiano (2011), innovation refers to the introduction of something new which involves an idea, process, or product; adoption is defined as when an individual integrates an innovation into their life and diffusion is the collective adoption process over time (Straub, 2009). The DIT seeks to explain how and why TLSTs are adopted with timelines potentially spread out through certain channels over long periods among the members of a community (Rogers, 2003). However, interpersonal communication within the community can also affect whether members adopt and thus help spur the adoption of innovations. Also, a household's experiences may be seen as more relevant and more trustworthy than what they hear from an agro-dealer/supplier representative, hence influencing the adoption of new technology.

Time and Labor- saving Technologies often involve some amount of investment; hence, the firm size/household's purchasing power is one of the major sources of heterogeneity affecting the timing of adoption. In general, it is believed that larger farmhouses tend to be early adopters. Credit accessibility, hiring and/or customer services have been identified to overcome the scale barrier to adoption (Olmstead and Rhode, 2001). Lu et al. (2016) supported this argument by observing that large farms that have adopted a new technology hire the use of it to smaller farmers. Over time, the rate of ownership increases as technology prices decline. Another source of heterogeneity may be differences in resource availability and quality as observed that adoption of TLSTs might occur in places with unreliable labour availability (Caswell and Zilberman, 1986).

Another theory that guides this study is Technology Acceptance Model (TAM). This model studies the relationship between human behavioural beliefs, normative beliefs and actual behaviour regarding information technology and adoption decision-making. The TAM has been advanced to serve as a framework for innovation diffusion and/or adoption studies as it utilizes both Theories of Reasoned Action (TRA) which focuses on the evolutionary analysis of technology adoption behaviour and the Theory of Planned Behaviour (TPB) which explains the universal model of individual behaviour (Ajzen and Fishbein, 1980). Therefore, as far as TLSTs are concerned, their diffusion to households and the community is influenced by the way these technologies have evolved and how the farmers both men and women have changed their behaviour towards adopting these technologies and using them.

Empirically, regardless of the changing contours of rural economy and preference for non-farm jobs, improvement, and efficient utilization of technologies in agricultural activities including the time consuming and labour-intensive activities such as land preparation and weeding, family labour has been found to overcome the challenge of automation systems which is the capacity to adapt to heterogeneity over space and time (Gallardo and Sauer, 2018). For example, Mehta (2019) argues that the use of herbicide-tolerant cotton reduced the labour time spent on these operations, which also enabled women engagement in activities that have significant productivity advantages and thus reduced the burden on female family members. Moreover, according to Esau et al. (2014), the automated chemical sprayers were found to be important by reducing humans' exposure to chemicals, and control the applied amount of chemicals because over-application could damage the plant itself and the environment as well as reducing labour costs. In addition, P´erez-Ru´ız et al. (2014) argue that automated weed control has the potential of reducing both production costs due to fewer labour hours dedicated to weeds removal and the herbicide application This technology also has a positive impact on the environment. Another example is the construction of protected springs close to the village which reduced the amount of time spent collecting water from about half a day to only minutes while improving water quality. Therefore, the time spared was spent on the kitchen, gardens, and rearing of cows and goats which produce milk that was sold for cash. This situation has also led to women stopping withdrawing their daughters from schools to help them fetch water (IFAD, 2007).

Furthermore, Rao (2002) also claims that women's access to bicycles increased their self-confidence and allowed them to become more involved in community activities. This is because it became easier for them to travel from one village to another although their workload also increased as their husbands were expecting them to undertake more tasks such as marketing and taking the children to school. These tasks were not possible when they were less mobile. In addition, mechanized mills were found to reduce the time needed to process one kg of rice from 19 minutes to 0.8 minutes in Nepal (Thomas et al., 2007) and 20 kg of sorghum from 2–4 hours to 2–4 minutes in Botswana (Spence, 1986.) Another example is the introduction of a mechanized grater, such that time spent on grating cassava tubers was reduced from one day to around 15 minutes. Thus, the time available or saved from these TLTs was diverted to other economic activities such as making more *gari* (a convenience food made from cassava) and engaging in retail trade. Moreover, the use of donkeys and carts supported by an NGO reduced the amount of time women spend each day collecting clean water for their household use (GRTI, 2006). Therefore, all these TLSTs have helped women to reduce the drudgery that they were facing and save more time on other economic and profitable activities for their household wellbeing.

3.0 Methodology

This study was done in the Coastal, Northern and Southern Highland regions of Tanzania. In the Coastal Zone, the study was done in Kilombero and Mkuranga districts in Morogoro and Coast regions respectively. In the Southern Highland zone, the study was done in the Mbarali district in the Mbeya region while in the Northern Zone, the study was done in the Babati district, in the Manyara region. The basis of selection for the regions was based on the production history, experience, volumes of production, trading activities and the status of the development of the value chains of the targeted crops, which were maize, rice, and cassava.

The research approach used was cross-sectional whereby data were collected at a single point in a time. Since this study was an explorative one, a rapid assessment method was used to collect the required data. This was suitable for describing characteristics that exist in the study population. Focus group discussions (FGDs) were mainly used to collect data and information from farmers who were testing and using targeted farm-level technologies with a fair composition of local stakeholders including men, women, and youths. One FGD was comprised of 6-8 farmers with different functions. About 210 smallholder farmers were involved in the discussions from all four districts. Discussions held were guided by a checklist of key points covering the major components of the assessment and types of data required in TLSTs. About 8 Key Informants Interviews (KII) with open-ended questionnaires were done in all four districts targeting agricultural extension officers and nutritionists in each district to explore more about the mechanization and nutrition impacts side of the TLSTs found in their districts. However, since this study was a rapid one, most of the data collected were mainly qualitative, with few quantitative ones.

4.0 Findings and Discussion

4.1 Findings

The study findings show that a variety of factors, such as household composition, can influence technology adoption and gender-differentiated time-use patterns (age and gender), In addition, marital status, education level, occupation, farming system, ease of accessibility to extension services and social services such as schools, clean and safe water, health centres, financial institutions, and markets can also influence adoption and use of TLSTs.

4.1.1 Socio-economic Characteristics of the Respondents

The findings show that the majority of respondents were young males aged between 36 to 55 years. This implies that many young people are engaged more in farming activities, therefore suggesting that the future sustainability of the crop production in the study areas is not something to be worried about. Also, this is the active working-age group which will therefore continue to be involved in agricultural production and marketing of farm produce for a longer time. The results also indicate that the majority of the respondents had a primary education level, closely followed by secondary education, and therefore, many of them could read and write without difficulty. Since most of the respondents had formal education, it is an incentive in making rational decisions regarding crops to produce and where to market. The preceding fact shows that a decision to engage in improved technologies in farming was related to the level of education that respondents had. Moreover, it is argued that higher well-being in some the farm families is also correlated with higher levels of education of the household head. Although, the findings also show that female household heads have lower educational levels than their male counterparts.

The findings also show that the majority of respondents were engaged in farming activities while fewer were salaried (off-farm) employed. Moreover, it was also found that farming activities are the most important source of income for most the households, accounting for about half of household income across all the districts. The relative importance of farming activities is also found in data at the individual level, confirming that the agricultural sector is crucial for rural livelihoods. The findings show further that the majority of the respondents were married, meaning that there was a chance to have more man-labour power compared to single or divorced households. However, the average household size across the entire sample was 5.12 people across the study districts.

4.1.2Gender Division of Labour among the Respondents

The results show that rural women in selected areas of Tanzania divide their time between domestic, agricultural, and non-agricultural activities (Table 2). The proportion of time allocated to each of these broad-based activities varies between and within regions, and between women in different households. Overall, however, the majority of women in all regions work around 16 hours a day. That is more than the number of hours men put in. In addition, a larger proportion of the total hours worked by women are devoted to unpaid work.

Table 2: Different tasks across the gender in hours/year

Task	Male	Female
Water collection	32	587
Crop establishment	194	251
Crop weeding	76	99
Crop harvesting	64	91
Health	25	73
Marketing	4	9
Grinding mill	21	169
Trips to market	51	227

4.1.3Status of TLST in the Study Area Sixty Years after Independence

The findings show that there are different agricultural inputs applied in farming as well as other resources in farm production. These inputs include seeds, fertilizer and agro-chemicals. Other resources include farming equipment and energy. All of these play an important role in agricultural value chain development, its performance and sustainability, to ensure growth in agribusinesses. The findings show further that the current status of resource use in smallholder production systems includes manual land preparation, ploughing and weeding with simple tools, and following traditional labour-intensive practices (Table 3). In addition, the findings also show that in agricultural production, most women provide labour and spend most of their time in some production activities as compared to men (Table 3). Therefore, the introduction of TLST will release women to other non-farm income generation activities. It was also noted further that introduction of these TLST will help women to balance time properly and increase in productivity, especially when improved technologies such as tillage implements and draft power are available since they reduce production time. Nevertheless, some of these technologies are unfriendly to women due to cultural values and some do not reduce a lot of drudgery faced by women. Therefore, it can be argued that some technologies have been introduced in Tanzania since independence but still, women are not favoured to use them based on culture.

Table 3: Labour inputs into rice crop production, by gender (person-days/hectare)

Operation	Traditional			Improved			Modern		
	Tech	Men	Women	Tech	Men	Women	Tech	Men	Women
Land preparation	Hand hoe	6.5	3.67	Plough	4.7	4.9	Ripper	4.13	4.13
Seedbed prep	Hand	0.73	0.58	Drum seeder	0.58	0.52	Drum seeder	0.58	0.52
Planting/sowing	Hand	1.73	0.57	Drought	1.0	0.75	Jab planter	2:2	
Gap filling		10.03	14.17		4.03	8.33		10.03	14.17
Weeding	Cover crop, stale seedbed, hand hoe	10.2	13.83	Drought	8:1	11.3	Weeder	6.9	7.04
Fertilizer		3.1	4.7		3.1	4.7		3.1	4.7
Pesticide app		5.4	0.63	Boom sprayer	5.4	0.63	Boom sprayer	5.4	0.63
Irrigation		3.67	1.17		3.87	0.67		3.67	1.17
Harvesting		26.4	19.03		13.67	12.60		26.4	19.03
Threshing and drying		14.97	13.8		17.57	12.33		14.97	13.8

4.1.4 TLST in Rice Value Chain Identified in Kilombero and Mbarali districts

Weed is the number one constraint in rice production in both Kilombero and Mbarali districts. However, the findings show that awareness of sustainable and cost-effective weeding technologies in rice-based systems is low. Therefore, without proper weed control in rice production, yield losses can range from 28% to 89%. One of the major contributing factors to the weeding losses is the lack of time and labour-saving weed control and management technologies among farmers. That is most rice producers in the study area, are still using hand hoes which are backbreaking and tedious to use in weeding and take so much time, including that of children who may even be made to stay away from school to help their parents in weeding exercise. This situation becomes more burdensome to rural women who are still bounded to undertake heavy domestic workload, thus making their time management extremely time-poor. In addition, a hand hoe does not reduce drudgery in weeding activities. Hence, binding women in both farming and domestic chores restricts their mobility, in both handling on and off-farm activities. This in turn will reduce their contribution to income generation activities and their ability to influence decision-making in households. Therefore, it can be argued that since independence, TLST has not reduced drudgery in women involved in rice farming activities such as weeding, harvesting and primary processing.

4.1.5 TLST Identified in Maize Value Chain in Kongwa District

Agricultural activities such as field clearing, sowing, weeding, harvesting, shelling and packaging of maize are still the most labour-intensive activities in the Kongwa district. Both men and women farmers are faced with difficulties during field clearing, sowing, weeding, harvesting, shelling, and packaging of maize because those activities are still done using traditional tools. The use of poor traditional agricultural tools results in low production level, poor quality of produced maize, increase in post-harvest loss of produced maize and time consumption. However, improved and modern equipment also exists but at the community level while the traditional technologies exist mostly in individual households. In production, both traditional tools (e.g., hand hoes) and modern and/or improved tools (such as tractors, power tillers and oxen-plough) were used. Oxcarts, bicycles, motorcycles, tractors, nd power tillers were often used for transportation (depending on a production level). In addition, during postharvest handling such as threshing, farmers use either maize threshing machines or hand beating, depending on the production level. In addition, during maize marketing, a weighing bridge was used at the marketplace instead of the common one i.e., buckets which were used before. Therefore, it can be argued that since Tanzania got its independence in 1961, TLST has been introduced in the maize value chain. However, their application is more common at the community level rather than at the household level. In addition, the TLSTs are more used by middle- and high-income households. Hence, for the poor and low-income households, women's drudgery is yet to be reduced in the maize value chain.

4.1.6 TLST Identified in the Fields in Mkuranga district

In the Mkuranga district, experience shows a transformation that has come slowly after some time in terms of the adoption of TLST. However, this has come due to the existence of particular programs implemented in the district, which focused on improving cassava production and processing, ready for sale in Dar es Salaam markets. The cassava products sold are either fresh, dried chips, or flour. However, cassava roots are tough so making them into dried chips and flour using traditional technologies takes time unless improved and/or modern technologies such as chippers and slicers are used. The chipper can process about 1 metric ton of cassava per day and the small mill can grind about 1.5 metric tons of products to flour, per day. Therefore, since independence, TLSTs have been introduced in cassava value chains and especially at processing nodes. The introduced TLST have not only saved hours if not days of processing time but also the technologies have improved the quality of cassava products from chips to flours. The production of high-quality products has led to an increase in the competitiveness of cassava products which in turn increases household incomes. Hence, the introduced TLST in the cassava value chain in the study area has not only reduced women's drudgery in cassava processing but also created a new business opportunity in terms of nutrition improvement for the cassava products consumed in the households as well as an increase in household income from the production of high-quality cassava products.

4.2 Discussion

The findings of the study show that there are some TLSTs which have been introduced in the three agricultural value chains of rice, maize, and cassava since independence. However, these technologies differ from one crop to the other. In addition, these technologies have been introduced in different nodes along the value chain. Therefore, for the case of time reduction, for smallholder farmers, women's labour is still used in ploughing and weeding. Thus, women spend more time in the fields when compared to men. This is supported by the findings that most women in all regions work approximately 16 hours a day; more than the number of hours spent by men. In addition, a greater proportion of women's total work hours are spent on unpaid activities (UNDP, 1995 as quoted by Carr and Harti, 2010).

The findings also show that there are different agricultural inputs applied in farming as well as other resources in farm production. These inputs include seeds, fertilizers, and agrochemicals. Other resources include farming equipment and energy. All of these play an important role in agricultural value chain development, its performance and sustainability to ensure growth in agribusinesses. However, since independence, some of the TLSTs have been introduced in planting, fertilizer application and production. However, at the household level, most of these technologies are not accessed by women and therefore their drudgery in these farming activities is still there. Moreover, in some crops such as maize and rice, these technologies have been introduced at the community level. Hence, only middle- and high-income households can afford them.

However, despite the fact that some introduced TLST are at the community level, in some value chains such as rice and cassava it has helped to release women to other non-farm income generation activities, especially the processing technologies. In addition, the introduction of these technologies has helped women to balance time properly and increase productivity a good example being the introduction of a power tiller in maize and rice ploughing and cassava processing. Although some of these technologies such as power tillers are unfriendly to women due to their design and labour requirements.

Therefore, since women play a crucial role in post-harvest processing and storage for both rice and maize and especially in threshing and winnowing, and in cassava processing, the introduction of TLST would reduce a lot of drudgery in these nodes. In addition, women are the ones who are used to transporting produce to the markets using their heads. However, the introduction of oxcarts and power tillers has reduced this burden. This has also led to an increase in women's representation on marketing nodes contrary to IFAD (2016) which argues that women tend to be excluded or confined to low-value, local markets as compared to men IFAD (2016) argues further that normally, women are underrepresented in engagements with informal or formal markets in cooperatives, with traders, or in other market-facing roles even when they are the producer of those goods (IFAD, 2016). This was due to cultural norms which restrict women's freedom of movement hence reducing their participation in these agricultural value chain nodes. However, in the case of cassava, women were marketing their cassava chips and flour. Hence, the introduced TLST have exposed more women to agricultural markets as it has been experienced in the cassava value chain.

5.0 Conclusion and Recommendations

5.1 Conclusion

The study findings show that task or labour division between men and women leads the latter to be more involved in crop production/farming activities; post-harvest handling and processing such as winnowing and milling; and transporting produce to the market. Regardless, of the evidence of the importance of TLSTs, efforts need to be emphasized on awareness and accessibility (such as cost-effectiveness and availability not far from the homesteads) though some have not reduced drudgery from women due to their nature and design which are still masculine and are not user friendly to women. Contrary to the belief that technologies including agriculture mechanization will displace workers, TLSTs will create better opportunities to move up in the value chain with new job tasks by reallocating time saved as result of work burden reduction.

5.2 Recommendations

This study found that TLSTs have been introduced in some agricultural value chains, but some are still unfriendly to women and therefore their adoption is low, even after sixty years of Tanzania's independence. However, some factors which seem to influence the uptake and sustainability of TLSTs observed by this study are affordability, reliability, ease of operation and maintenance costs. These factors have been addressed in some literature and must be considered in further studies. Overall, it is recommended that the pathway for developing, testing and upscaling these TLSTs should not ignore the key questions which will influence their adoption which include:

i) creating awareness through training and/or workshops to different stakeholders;
ii) providing or bringing a better option;
iii) ensuring acceptability;
iv) meeting the priority needs of the women; and,
v) Being easily accessible and affordable to women.

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