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Equity and Efficiency in Women-Empowered Contract Farming: An Explanatory Case Study on the Tea Estate Sector of Sri Lanka

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Abstract: Essentially, equity and efficiency are integral parts of any economic activities of sustainability though the correlation and causation between those two constructs are not considered significant. This study intends to evaluate if the contract farming system is a sustainable solution to the prevailing socio-economic aspects of the labor productivity problem in the tea estate sector of Sri Lanka, where female workers are highly depressed. This study has employed the survey strategy within the instrumental case of a selected tea estate to assess equity and efficiency of women-empowered contract farming system. The analytical results for gender equity on input and performance indicators have proven that gender equity is maintained in contract farming at the sample tea estate. The efficiency analysis results revealed that the output elasticity of tea bushes is significantly lower for female farmers than male farmers. However, there is no such significant difference revealed in the output elasticity of labor between gender groups. These findings explicitly reveal that the female workers in the tea estate sector are capable of managing labor although they are dominated by males in the domesticity. It further implies that a transformation of the male-dominant culture of the tea estate community would enhance the entrepreneurial and leadership capabilities of female workers if they are provided with equal opportunities and freedom.

Keywords: *Contract farming, efficiency, equity, human development, well-being.*

1. Introduction

The problem of low productivity in the tea estate sector of Sri Lanka is attributed to both land and labor input factors, as those factors complement the production process. Although Sri Lanka is renowned for producing high-quality teas to the world market, this industry's land and labor productivity is significantly less than that of other competitive tea growing and exporting countries such as India and Kenya (Shyamalie, Welala, & Godage, 2013). Hence, these two productivity perspectives are crucial in enhancing competitiveness as this industry is exceedingly land and labor-intensive. However, this productivity issue appears to be the tip of the iceberg as the real cause remains unresolved though the employers and the government have taken primitive measures. The real cause of this productivity problem has mainly resulted from the social obligation of the employers and the government with respect to the social well-being of resident tea estate workers which is well below the national standards. The tea estate sector of Sri Lanka is in various political and economic discussions at the national level for different reasons. These residential workers are immigrants from South India during the British colonial period that is still considered a separate community of Sri Lanka.

The economic value created by this sector to the Sri Lankan economy is immense due to its significant contribution to employment and export earnings. However, the prevailing destructive socio-economic condition of this community is characterized primarily by low income, poor living conditions, and lower social status. Such socio-economic conditions have adversely affected the quality of labor resulting in low productivity (Dishanka & Ikemoto, 2014). Besides, the low socio-economic condition of tea estate workers has discouraged them from participating in tea estate work, creating an adverse effect on the labor supply (Dishanka & Ikemoto, 2018). Thus, the remote and unattended part of the above productivity problem of the tea estate sector of Sri Lanka is primarily socio-political as it is associated with human development fundamentals. In developing a solution for this chronic socio-economic problem in the estate sector, it is pivotal to consider the human development aspect. The outcomes of such a solution should bring in improvements in social, political, and financial spheres of human life and endure over time to be sustainable (Alkire & Deneulin, 2009). Since the inception of the Human Development Report launched by UNDP in 1990, the idea of human development has been the focal reality by drawing attention towards.

The human aspect of development, especially in realizing sustainability in development. According to human development essentials, any economic activity should be enriched with efficiency, equity, and empowerment as fundamental requisites (Ul-Haq, 2003). However, the absence of such essentials in the existing labor-management system in the tea estate sector of Sri Lanka has created social unrest within the worker community. Notably, the overburdened workload of female workers and male-dominant culture has violated the empowerment fundamental of human development. Moreover, such ill-treatment is not equitable and efficient for sustainable human and community development (Philips, 2003) (Samarasinghe, 1993). Accordingly, this study hypothesizes the contract farming (CF) system for the tea estate sector in Sri Lanka as a viable and sustainable commitment-driven alternative model enriched with human development fundamentals (Panotra, Gupta, Sharma, & Kumar, 2018).

Here, we discuss how CF could enhance estate workers' well-being and capabilities of women while improving labor productivity concurrently. We presume that empowering women by prioritizing them for new investments or reallocating existing resources is of utmost importance (Anderson, Reynolds, Biscaye, Patwardhan, & Schmidt, 2021). In light of similar study outcomes, the researchers have prepositioned that a small-scale CF system in the tea estate sector in Sri Lanka would align the production system with human development essentials. Therefore this is a comprehensive study to evaluate if CF in the tea estate sector in Sri Lanka meets the fundamental human development essentials to resolve the chronic socio-economic problem which has hindered the productive performance of workers over decades. The significance of this study is the special attention and reference given to the potential role of female workers in improving the tea estate sector performance through enhanced capabilities.

2. Literature Review

Contract Farming, Farmer Well-Being and Human Development: Contract farming (CF) refers to a system whereby a processing or distributing firm purchases the farmers' harvest based on a contract made between the two parties (Glover, 1984). However, the contract's exact nature varies considerably from case to case. In a typical CF scheme, local farmers supply the harvest while the firm retains technical assistance and marketing responsibility. Generally, purchasing firms and farmers commit to a clear definition regarding each entity's duties and responsibilities. The purchasing firm agrees upon the supply of resources and purchasing price based on a rational formula, while the farmers agree upon the quantity requirements and quality specifications. The contractual arrangement's intensity varies according to the depth and complexity of conditions in resource provisions, production specifications and market provisions (Food and Agriculture Organization, 2001). In many developing countries, the agricultural sectors are based on production systems with primitive technology where many smallholder farmers' engagement in it is for a subsistence purpose (Bellemare, 2015). Although small-scale farmers are not competitive in the open agrarian market, they might probably be the most economical and profitable if agro-business firms contract with them (Key & Runsten, 1999). If the policymakers of developing countries plan to develop a more modern agricultural sector in the country.

It should be accompanied by developing rural labor markets and rural businesses (Bellemare, 2018). Various studies conducted on CF have revealed interesting outcomes with respect to human and community development. CF has been a component of the most successful income-generating projects for smallholders (Glover, 1984); (Kirsten & Sartorius, 2002); (Singh, 2002). It provides an opportunity for farmers to earn higher incomes by challenging their production capabilities and exposing them to a competitive market environment (Faizi & Shah, 2014). However, the impact is not limited to income generation. It has a much broader impact on human development, especially on complex capabilities such as being independent, making decisions, and having self-respect. A study on state-administered CF schemes in Malaysia's poultry industry has emphasized that it is a part of a broader national goal to eradicate poverty and raise rural income (Morrison, Murray, & Ngidang, 2006). This scheme intends to develop entrepreneurship among the disadvantaged indigenous 'Bumiputra' minorities. According to the authors, the state plans to improve the level of living of this disadvantaged minority rather than promoting competitive entrepreneurship. CF not only significantly increases income and raises the standard of living of farmers but also had positive multiplier effects on the regional economy, employment, and infrastructure (Warning & Key, 2002). A study on apples and green onions farming in Shangdong province.

China has revealed that three-quarters of contract farmers perceived an increase in income after they began CF (Miyata, Minot, & Hu, 2009). The CF has enabled them to step out of poverty and access better opportunities in enhancing capabilities such as quality housing and better education for their children. A successful case of small-scale tea growers in Kenya has achieved incomes above the national average by participating in CF (Glover, 1984). Such a rise in income has allowed them to access better basic capabilities to improve their quality of life. Notably, this rise in income has reduced income inequality to a certain extent. However, the income effect of contract farming could be realized only if the conditions of the contract are clear to the highly vulnerable smallholder farmers (Mwambi, Oduol, Mshenga, & Saidi, 2016). In the absence of such provision, the market fluctuations (such as the price) might affect the farmers' income efficiency. This has occurred in Vietnam, in which coffee farmers' income was adversely affected due to the gradual fall of the world coffee price in and after 1997 (Ikemoto, 2004). Accordingly, such economic improvements would increase people's economic choices and create positive effects on human development by providing greater opportunities and accessibility to a wide range of economic capabilities.

The Youth and Women in Farm Management: The comparative advantage of younger workers lies primarily in the hard skills such as flexibility, physical and mental capacity, and willingness to learn new technical skills than soft skills such as emotional intelligence, communication, and decision making skills (Van Dalen, Henkens, & Schippers, 2010). This is mainly because the critical hard skills of labor are positively and directly related to their productivity. Therefore, losing such young productive workers from agriculture inversely affects agricultural productivity. This emphasizes the importance of an alternative action such as CF to attract and retain young productive workers in agriculture. The younger generation is reluctant to become merely farming employees of someone else's land but expects to become independent farmers who manage a farm (White, 2012). This implies that CF would satisfy this youth's requirement in the agricultural sector by retaining their hard productive skills within the sector. Therefore, CF's entrepreneurial nature seems to be an effective method that meets the young productive population's expectations and keeps them in the farming community. Other than the community and farmer gains of contract farming, it is ideally important to identify the impact on women and their livelihood.

Although CF redresses the economy's power imbalances between farmers and agribusiness firms, it has largely ignored empowering women (Brewin & Murphy, 2019). Participation of women in contract farming may have positive effects on their financial independence and household bargaining power, especially in male-dominant domesticity. However, such empowerment would be effective only if the farming community recognizes the women's contribution (Adams, Gerber, & Amacker, 2019). In the process of measuring women's empowerment in contract farming with respect to control of assets, there has been a positive correlation between contract farming and women's control of land resources (Navarra, 2019). Moreover, in African agriculture, the degree of efficiency of women farmers has been similar to that of male farmers (Adesina & Djato, 1997). According to a study in agro-ecological regions in Bangladesh, it has identified that female labor in farming is significantly substitutable to male labor (Rahman, 2010). However, male farmers have more opportunities from the market system and uphold wages and income control than women (Mitra & Rao, 2021). The return on investments in empowering women in agriculture could be significant if they were given productive agricultural resources (Anderson, Reynolds, Biscaye, Patwardhan, & Schmidt, 2021).

This claim was further confirmed in a study on maize production in Southern Ethiopia. That study has revealed that the maize production sector favors male farmers due to the significant productivity gap maintained with female farmers. This productivity gap has been confirmed in a study in Kenya which identified a mean technical efficiency of 62% and 56% in male-managed and female-managed farms (Njuki, Kihiyo, O'Ktingati, & Place, 2006). However, the researchers have further identified that this productivity gap could have been reduced significantly by providing equal opportunities and access to productive resources to female farmers (Gebre, Isoda, Rahut, Amekawa, & Nomura, 2019). Providing such equal opportunities to women may empower them with greater control over household activities and income (Akter, et al., 2017). Although, the above studies reveal either uniformity or diversity in gender-based productivity outcomes; the marginal product of male or female labor fairly depends on the relative scarcity of labor and the labor division in different farming systems (Quisumbing, 1996). Therefore, the results and findings of the above studies could result from methodological imperfections in sampling and analytical techniques. As an alternative labor deployment model to the unproductive traditional system of the tea plantation sector of Sri Lanka.

Research Design: This study could primarily be identified as a case study research as the principal subject (Contract farming) cannot be separated from the selected context. Importantly, the selected tea estate is the pioneer and the most successful case in employing CF. However, the researchers have adopted the survey strategy within the case study as the social constructs (equity and efficiency) is to be objectively hypothesized and tested against theoretical explanations. Thus, the research methods (data collection and analysis) of this study have been employed in light of hypothetico-deductive positivism. In this study, the two social constructs; equity and efficiency have been conceptualized through gender-based indicators (Tirado, Morales, & Calleros, 2015); (Pannell & Schilizzi, 1999); (Plumecocq, Debril, Duru, Magrini, Sarthou, & Therond, 2018). Moreover, these two concepts were operationalized and tested using the gender dimension as human development and economic sustainability should be gender-neutral. Therefore, amidst practical limitations and obstacles, a representative sample was selected from the instrumental case to avoid any possible methodological flaws in data collection which might subsequently result in analytical complications. Out of the 250 contract farmers in the study estate, 100 farmers were selected in total. The composition of this sample was 44 male and 56 female farmers while the number of sample farmers (both male and female) was 20 from each of five divisions of the tea estate.

Operationalization - Indicators and Measurements: The variables used for the analytical purpose are categorized as performance indicators and farmers' and farm characteristics (Table 1). The CF performance indicators are further classified into output indicators, input indicators, and subjective evaluation of CF. One of the output indicators is the harvest per week of a contract farmer. This includes the harvest as a contract farmer in CF. But this does not include the harvest as a worker employed by the estate management in the traditional system. The other main output indicator is the monthly income earned by a contracted farmer from CF. Contract farmers receive a wage as employed by the estate, but the 'income earned by a contract farmer' excludes such wages. The monthly income of CF consists of the earnings for the contract farming which is 64% of the value of harvested green leaves in a month. This monthly income is obtained by subtracting the paid cost of hired labor, fertilizer, and chemicals from the monthly revenue. Thus, it can be termed as the monthly net income of CF. Input indicators are the number of tea bushes per contract farmer, the number of family workers used by a contract farmer, and the number of hired workers used by a contract farmer. Subjective evaluation of CF is an opinionated assessment of CF by the contract farmers, which is highly influenced by his/ her feelings and perception. Therefore, the farmer's intention to continue CF in the future is considered an indicator of subjective evaluation of CF. this depends on the farmer's evaluation of the perceived marginal benefits of CF over its marginal costs. These marginal benefits and costs may include both explicit and implicit components.

3. Method of Data Analysis

(i) Two-Way Manova with Interactions: Gender equity in CF is one of the main concerns of this study as females have been unfairly treated in the tea plantation sector's traditional labor-management system. Moreover, land productivity is a crucial geographical factor in determining labor productivity. Therefore, to examine the influences of gender and land productivity on CF output, two-way MANOVA is employed in this section, where dependent variables are the output indicators (harvest and income) and categorical independent variables are gender and division of the tea estate. The division is used to capture differences in land productivity. Two-way MANOVA is particularly suitable because the interactions between gender and land productivity (i.e., division) are the primary concerns. The independence of observations, multivariate normality, linearity of dependent variables, and the homogeneity of variance and covariance were tested and confirmed to conduct MANOVA properly.

(ii) Multiple Regression Analysis: Other than the influence of gender and division (i.e., land productivity), other observable or unobservable factors might affect CF performance. Thus, by estimating the reduced form of CF performance equations, three direct questions are to be answered in this section. First, what are the factors affecting CF performance other than gender and division? Second, even after controlling for such factors, do gender and division have an insignificant effect on CF performance? The final inquiry is if the current practice is efficient, even if it is equitable for gender. To answer the last inquiry, a Cobb-Douglas production function could be estimated. CF performance equation is given by;

$$P_{CF} = a + \theta * Female + \varphi \mathrm{X} + \omega \mathrm{D} + \varepsilon \quad (1)$$

Where P_{CF} is one of the 10 CF performance indicators provided in Table 1.

Female is a dummy variable taking 1 when the contract farmer is female and 0 otherwise, and θ is the coefficient for the female dummy. X is the vector of farmers' and farms' characteristics also provided in Table 1 and D is the vector of division dummy variables. φ and ω are the vectors of coefficients to be estimated, a is the constant, and ε is the error term. Equation (1) will be estimated by OLS for each dependent variable independently. Our hypothesis is that gender does not affect CF performance. It is tested by the estimation of θ. If it is not significantly different from zero, the hypothesis is supported. As for the Cobb-Douglas production function, it is specified as equation (2) below.

$$log(Q) = A + \alpha * log(L) + \alpha_F * Female * log(L) + \beta * log(T) + \beta_F * Female * log(T) + \epsilon \quad (2)$$

Where Q: Weekly harvest of green leaves by the contract farmer (kg)
A: Constant
L: Number of labor hours in a week
T: Number of tea bushes assigned to the contract farmer
Female: A dummy variable for female contract farmer
ϵ: error term
α, α_F, β, and β_F are the coefficients to be estimated.

We hypothesize that production inputs, namely labor and tea bushes, are efficiently allocated between genders. It is tested by the coefficient for the interaction terms of production input and female dummy (i.e. α_F and β_F). If the coefficient is not statistically different from zero, the input is efficiently allocated between genders.

4. Data Presentation and Analysis

As shown in Table 1, the total harvest is highly variable, ranging from 33 to 100 kg/week with a mean of 64.3 kg/week and a standard deviation of 13.9 kg/week. This is because the number of tea bushes assigned is not equal: it varies, probably depending on the farmer's characteristics such as gender, age, family size, CF experience, etc. CF income is also highly variable, ranging from Rs. 3,500 to Rs. 12,000 with the mean of Rs. 7,330 and the standard deviation of Rs. 1,890. The scatter diagram shown in Figure 1 depicts the causality between output and net income. It clearly shows a linear relationship of 0.73 between the two variables. The variation of the harvest and the income of CF would have been much lower if there was a common rule in allocating tea bushes to contract farmers.

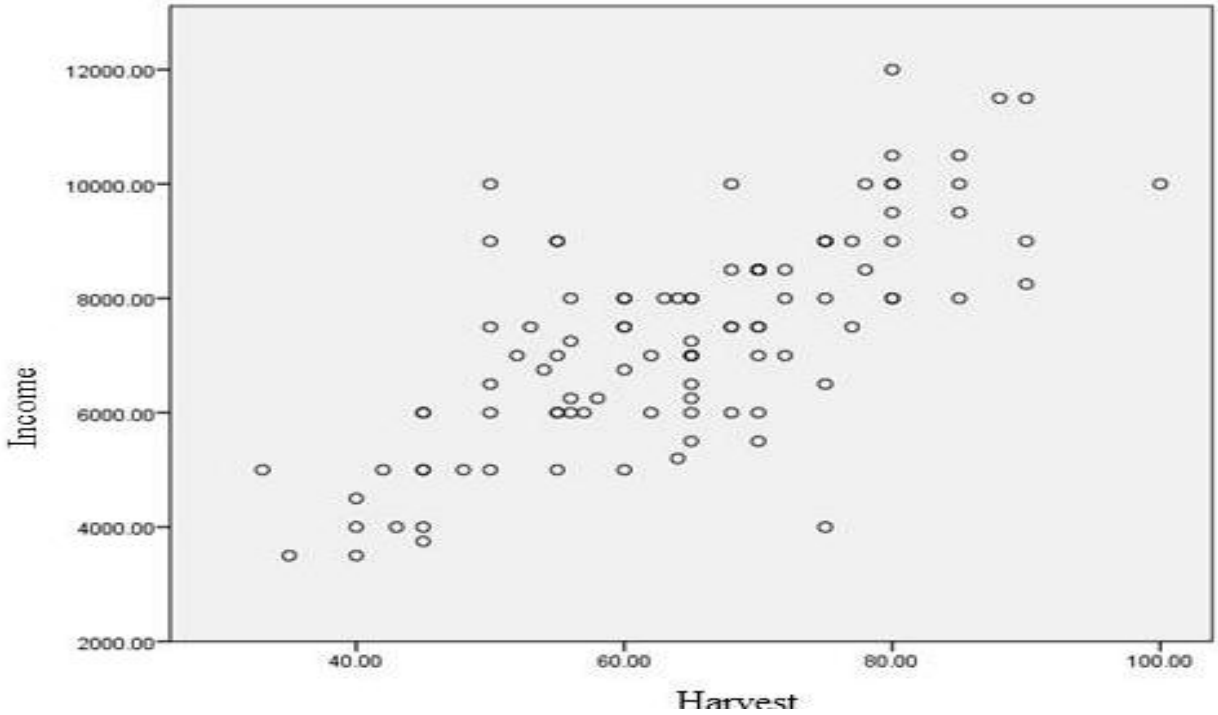
Table 1: Descriptive Statistics of Sample Contract Farmers (N=100)

Variable	Description	Mean	Median	SD	Min.	Max.
Output indicators						
Total harvest	Harvested weight (kg) of tea leaves in a week	64.3	65	13.9	33	100
Harvest per worker	The above is divided by No. of workers	18.9	19	4.87	10	35
CF income	Revenue less paid out cost in a month	7330	7500	1890	3500	12000
CF Income per worker	The above is divided by No. of workers	2160	2187	564	1000	3500
Input indicators						
Tea bushes	No. of tea bushes assigned to a contract farmer	1330	1300	157	1000	2000
Tea bushes per worker	The above is divided by No. of workers	390	400	111	233	700
HH labor	No. of workers for CF from the household	2.36	2	0.61	1	4

HH labor per member	The above is divided by No. of household members	0.45	0.5	0.15	0.14	1
Hired labor	No. of workers hired for CF	1.04	1	0.90	0	3
Subjective evaluation of CF						
Future CF	Farmer's willingness to renew CF	2.91	3	1.02	1	4
Contract farmer's and farm characteristics						
Gender	Contract farmer (Male = 1 and Female = 0)	0.44	0	NA	0	1
Age	Age of the contract farmer (No. of years)	51.2	51.5	8.05	35	65
Family size	No. of members of the contract farmer's HH	5.22	5	1.59	2	10
Education	No. of years in education of the contract farmer	4.46	5	3.16	0	10
Estate experience	No. of years of working in the estate	31.4	32	8.44	10	48
CF experience	No. of years working under CF	9.69	10	3.37	3	15
Distance	Km from the residence to assigned division	1.72	1.75	0.78	0.5	3.5
Management support	Continuous guidance and monitoring by the management	2.90	3	0.93	1	4

Note: SD, Min., Max., HH, No., and CF stand for standard deviation, minimum, maximum, household, number, and contract farming respectively.

Figure 1: Scatter Diagram of Harvest and Net Income



Despite the large variance in performance indicators, Table 2 shows that they are not different between females and males. Moreover, production inputs are also equally distributed between genders. It is valid with farmers' and farm characteristics as well. Therefore, it is worth mentioning that both female and male

samples are almost identical in characteristics and performance. This implies that gender discrimination in the traditional labor-management system has depressed the females, but CF has empowered women and done justice to them. This has basically proven that gender equality is maintained in this CF practice which has done justice to female workers. However, this claim is yet to be proven statistically with more facts and figures, which is one of the main intentions of this study.

Table 2: Comparison between Female (N=56) and Male (N=44)

	Female Contract Farmers				Male Contract Farmers				Mean Difference
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	
Total harvest (kg/week)	64.4	14.4	33	100	64.1	13.5	42	90	0.337
Harvest per worker (kg/week)	19.0	4.78	10	32.5	18.8	5.01	11.67	35	0.25
CF Income (Rs/month)	7360	1940	3500	11500	7290	1840	3750	12000	70.9
CF Income per worker (Rs/month)	2170	549.2	1167	3500	2138	587.8	1000	3500	27.21
No. of tea bushes (number)	1320	142	1000	1600	1330	176	1050	2000	-8.12
Tea bushes per worker	390	96	250	700	390	127	233	667	0.00
HH labor (number)	2.34	0.58	1	4	2.39	0.65	1	4	-0.047
HH labor per member (number)	0.46	0.15	0.25	1	0.44	0.14	0.14	1	0.023
Hired labor (number)	1.05	0.90	0	3	1.02	0.90	0	3	0.31
Future CF (integer from 1 to 4)	3.02	0.96	1	4	2.77	1.08	1	4	0.245
Age (years)	52.0	7.13	35	65	50.3	9.10	36	64	1.65
Family size (number)	5.09	1.52	2	8	5.39	1.69	2	10	-0.297
Education (years)	4.80	3.01	0	10	4.02	3.33	0	10	0.781
Estate experience (years)	31.5	7.32	15	46	31.2	9.77	10	48	0.358
CF experience (years)	10.0	3.42	3	15	9.30	3.30	4	15	0.704
Distance (km)	1.73	0.81	0.5	3.5	1.69	0.73	0.5	3.5	0.039
Management support (integer from 1 to 4)	3.02	0.82	1	4	2.75	1.04	1	4	0.268

Note 1: SD, Min., Max., HH, No., and CF stand for standard deviation, minimum, maximum, household, number, and contract farming, respectively.
Note 2: The results of the t-test indicate that none of the mean differences is statistically different from zero even at the 10% significance level regardless of the equality assumption of variances.

Table 3: Pearson Chi-Square Tests for the Effect of Farmers' Characteristics

	Value	DF	Sig. (2-sided)
Division * Age	107.714	120	.782
Division * Family size	27.073	32	.714
Division * Education	29.982	36	.750

As shown in Table 3, none of the contract farmers' characteristics is significant for the divisional variance in harvest and income based on Chi-Square tests. Therefore, we should consider that the output indicators are affected by unobservable factors such as individual capacities. For example, the availability of more household labor than hired labor would enable them to earn higher income as household labor is unpaid.

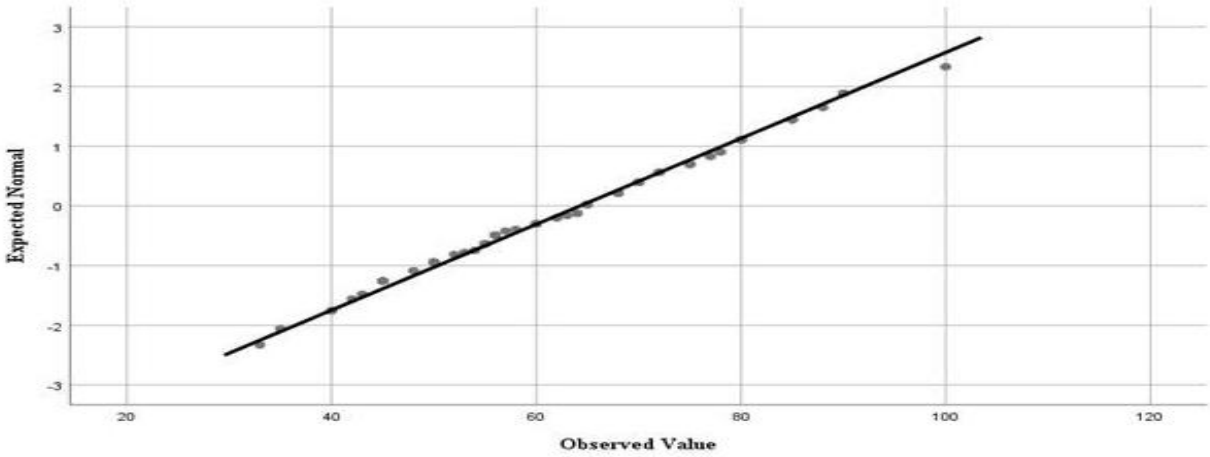
Preliminary Analysis: The MANOVA test results show that the significance values of harvest and income are 0.629 and 0.313, respectively (Table 4), which means that each variable is normally distributed. The Kolmogorov-Smirnov test result shows that the significance value is 0.200 (This is the lower bound of the true p-value of significance, indicating the true p-values is greater than 0.200) for each, which confirms the normality.

Table 4: Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	DF	Sig.	Statistic	Df	Sig.
Harvest	.061	100	.200*	.990	100	.629
Income	.069	100	.200*	.985	100	.313

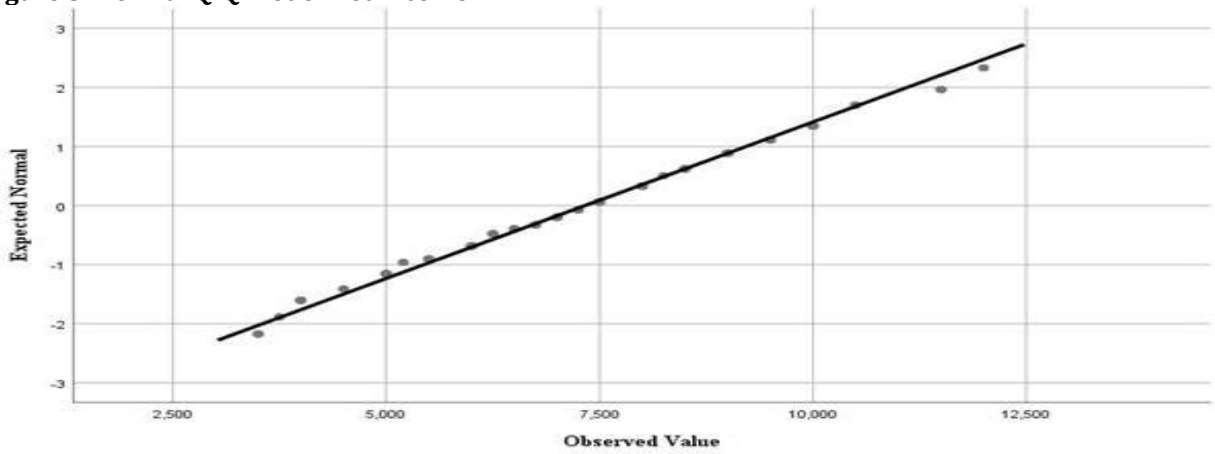
*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Figure 2: Normal Q-Q Plot of Harvest



The normal Q-Q scatterplots of harvest and income in Figures 2 and 3 show that all the points are scattered with linear approximation, confirming that both variables are normally distributed. Although there is a little random wriggle around the line, this does not disqualify the normality of the data as confirmed by both Shapiro-Wilk and Kolmogorov-Smirnov tests for normality. After confirming all the conditions of two-way MANOVA, it is conducted to test if gender and division interactions have any effect on the output indicators collectively.

Figure 3: Normal Q-Q Plot of Net Income



Wilks' Lambda test (Table 5), which is most commonly used in two-way MANOVA reveals that none of the independent variables and their interaction significantly affects the combined output indicators (i.e., harvest and income). The main intention of MANOVA is to check if there is any significant difference in harvest and income between gender and in five tea growing divisions of the study estate. The results of MANOVA confirm that contract farmers from all five divisions have equal opportunities for harvest and income regardless of gender.

Table 5: MANOVA Results (Wilks' Lambda Test)

Effect	Value	F	Hypothesis DF	Error DF	Sig. (p-value)
Intercept	.043	998.865	2	89	.000
Division	.908	1.104	8	178	.362
Gender	1.000	.019	2	89	.981
Division * Gender	.889	1.350	8	178	.222

Results of Regression Analysis

Gender Impact on CF Performance: OLS regression results of six output indicators are presented in Table 6. It is found that the female dummy does not have a significant effect on any of the output indicators. The dependent variable of the last column of Table 6 is current contract farmers' subjective evaluation of CF, or their willingness to renew CF. In this case, as well, the female dummy does not have a significant effect. Table 7 presents the OLS regression results of seven input indicators. The female dummy does not affect input indicators, either. Thus, overall we can conclude that gender equality in terms of input use and output is realized in CF.

Table 6: Effect of Gender on CF Performance: Output Indicators and Subjective Evaluation

Independent Variables	Weekly Harvest	Weekly Harvest per 1000 Tea Bushes	Weekly Harvest per HH Labor	CF Income	CF Income per 1000 Tea Bushes	CF Income per HH labor	Willingness to Renew CF
Female	-0.45	0.19	-0.88	89.5	32.6	-3.07	-0.26
	(4.47)	(1.81)	(2.29)	(328)	(31.0)	(55.7)	(0.15)
Age	-0.40	-0.11	-0.25	-27.5	0.71	-4.32	-0.05
	(0.25)	(0.16)	(0.20)	(25.4)	(3.06)	(4.98)	(0.02)**
Family size	0.38	-0.06	-2.17	136	15.8	-47.9	0.08
	(0.33)	(0.18)	(0.89)*	(38.3)**	(8.56)	(29.4)	(0.04)
Education	-0.75	-0.01	-0.57	-110	-6.83	-18.9	-0.04
	(0.54)	(0.36)	(0.46)	(72.8)	(6.82)	(13.0)	(0.04)
Contract experience	1.53	0.87	0.47	259	413	23.1	0.14
	(0.82)	(0.34)*	(0.40)	(85.9)**	(10.1)**	(12.4)	(0.02)***
Distance	-1.12	-0.89	-1.53	-272	-51.7	-61.0	0.04
	(2.31)	(0.89)	(1.55)	(208)	(25.2)	(53.3)	(0.11)
Management support	3.27	1.38	0.72	704	102	60.8	0.14
	(1.11)**	(0.48)**	(1.24)	(107)***	(21.1)***	(33.7)	(0.09)
Division							
2	10.6	5.30	8.46	397	-14.8	158	0.41
	(1.64)***	(0.99)***	(0.99)***	(148)*	(27.1)	(29.3)***	(0.10)**
3	6.55	2.71	2.40	180	-45.5	-8.86	0.54
	(0,84)***	(0.46)***	(0.81)**	(62.0)**	(6.49)***	(20.1)	(0.05)***
4	6.12	2.18	1.11	735	43.6	16.7	0.57
	(2.04)**	(0.96)*	(0.94)	(202)**	(23.3)	(28.1)	(0.06)***
5	8.23	4.16	1.84	608	34.1	8.92	0.87
	(3.70)*	(1.57)*	(1.49)	(361)	(37.3)	(42.6)	(0.08)***
Constant	57.6	40.8	49.3	4015	668	1050	3.06

	(23.2)*	(11.3)**	(10.4)***	(2442)	(146)**	(201)***	(0.99)**
R-squared	0.320	0.285	0.220	0.576	0.494	0.283	0.445
Number of Obs.	100	100	100	100	100	100	100

Note: Estimated by OLS. Robust standard errors clustered at the division level in parentheses. *** significant at 1% level, ** significant at 5% level, and * significant at 10% level.

Table 7: Effect of Gender on CF Performance: Input Indicators

Independent Variables	Number of Tea Bushes Assigned	Number of HH Labor used in CF	Number of Hired Labor used in CF	Total of HH and Hired Labor in CF	HH Labor per 1000 Tea Bushes	Hired Labor per 1000 Tea Bushes	Total Labor per 1000 Tea Bushes
Female	-9.82	0.05	-0.03	0.02	0.03	-0.01	0.03
	(53.7)	(0.15)	(0.23)	(0.19)	(0.10)	(0.16)	(0.08)
Age	-7.04	0.00	-0.03	-0.02	0.01	-0.02	-0.01
	(4.57)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)
Family size	12.4	0.19	-0.07	0.12	0.13	-0.05	0.08
	(6.27)	(0.06)**	(0.05)	(0.04)**	(0.04)**	(0.04)	(0.03)*
Education	-17.0	0.01	-0.05	-0.03	0.03	-0.03	0.00
	(8.81)	(0.03)	(0.06)	(0.04)	(0.03)	(0.04)	(0.03)
Contract experience	9.09	0.03	0.05	0.09	0.02	0.04	0.05
	(8.75)	(0.01)*	(0.01)***	(0.02)**	(0.01)	(0.01)**	(0.02)**
Distance	4.36	-0.01	0.01	0.00	-0.02	0.01	-0.01
	(24.4)	(0.08)	(0.10)	(0.08)	(0.05)	(0.08)	(0.05)
Management support	23.1	0.04	0.09	0.13	-0.03	0.05	0.03
	(16.4)	(0.04)	(0.16)	(0.13)	(0.05)	(0.12)	(0.08)
Division							
2	86.3	-0.13	-0.03	-0.15	-0.22	-0.02	-0.25
	(5.11)***	(0.07)	(0.12)	(0.08)	(0.04)***	(0.08)	(0.05)***
3	89.6	0.06	-0.09	-0.03	-0.08	-0.06	-0.14
	(5.89)***	(0.02)**	(0.04)	(0.03)	(0.02)***	(0.03)	(0.02)***
4	78.2	0.33	-0.06	0.27	0.12	-0.04	0.08
	(18.3)**	(0.04)***	(0.04)	(0.07)**	(0.00)***	(0.03)	(0.03)*
5	71.4	0.17	0.11	0.28	0.03	0.07	0.10
	(37.8)	(0.07)*	(0.06)	(0.11)*	(0.02)	(0.05)	(0.03)
Constant	1470	0.60	2.08	2.68	0.35	1.54	1.89
	(382)**	(0.84)	(0.75)*	(0.93)**	(0.65)	(0.48)***	(0.70)*
R-squared	0.217	0.349	0.106	0.249	0.256	0.085	0.173
Number of Obs.	100	100	100	100	100	100	100

Note: Estimated by OLS. Robust standard errors clustered at the division level in parentheses. *** significant at 1% level, ** significant at 5% level, and * significant at 10% level.

Concerning factors affecting CF performance, there are some more remarks. First, as shown in Table 6, division dummies show significant influences on output indicators. As discussed previously, this may reflect the variation of land productivity among the divisions. Second, besides, management support tends to be positively associated with output indicators. On the other hand, as shown in Table 7, family size seems to allow contract farmers to use more family labor, as expected. It increases total labor use as a consequence. However, Table 6 shows that the association between family size and output indicators is not straightforward. While family size does not increase harvest and negatively affects harvest per household labor, it increases CF income. However, it has no significant effect on income per household labor despite a highly positive correlation between harvest and CF income. Lastly, experience in CF increases labor input (Table 7) and tea output (Table 6). Other explanatory variables such as age, education, and distance to the contract farm have little influence on either output or input indicators.

Productive Efficiency of Contract Farming: The analysis of the previous section has proven that there is no gender difference in terms of production inputs as well as outputs of CF. Therefore, as a human development essential, gender equity is guaranteed in the CF system. The remaining question is if such allocation is efficient. To answer this question, equation (2) is estimated and the results are presented in Table 8. The main input variables (labor and tea bushes) were occupied in the basic production function (Model 1). The model has suggested that both input variables are significant at 5 percent and 1 percent, respectively. The model has further proven that the output elasticity of tea bushes is highly elastic which is greater than one. The female dummy was occupied in Model 2 to identify the gender impact on the output. However, it did not prove any significant difference in output from male farmers. This model was further enriched with farmer and farm characteristics as control variables.

All the control variables except family size were insignificant in output determination. The gender difference in efficiency is further captured by the interaction terms with the female dummy in models 3 and 4. In either model, while the output elasticity of labor is not influenced by the female dummy, that of tea bushes is affected by the female dummy. The output elasticity of tea bushes is significantly smaller in female contract farmers on average in the case of male contract farmers. It is apparent as the coefficient values of the number of tea bushes with the interaction of female dummy are negative and significant by 0.85 (at 10%) and 0.78 (at 1%) in Model 3 and 4, respectively. This result implies that there is allocative inefficiency in the CF of the tea estate. Suppose the number of tea bushes under contract shifts from female farmers to male farmers, total output under CF of this tea estate will increase. In other words, equal allocation of tea bushes over the gender is not necessarily desirable from the viewpoint of economic efficiency.

Table 8: Estimation of Cobb-Douglas Production Function of Green Leaves

	Model 1 Inputs Only	**Model 2 With Control Variables**	**Model 3 Interaction with Female Dummy**	**Model 4 Constant Return to Scale Imposed**
Labor (hours/week)	0.15 (0.04)**	0.12 (0.04)**	0.09 (0.04)	0.09 (0.05)**
x Female dummy	NA	NA	0.02 (0.07)	0.03 (0.07)
Tea bushes (number)	1.29 (0.26)***	1.25 (0.17)***	1.68 (0.12)***	1.66 (0.09)***
x Female dummy	NA	NA	-0.85 (0.31)*	-0.78 (0.11)***
Female dummy	NA	0.02 (0.03)	6.07 (2.19)*	5.52 (0.63)***
Control variables				
Age	-	-0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Family size	-	-0.01 (0.00)*	-0.01 (0.00)*	-0.01 (0.00)**
Education	-	0.00 (0.01)	0.00 (0.00)	0.00 (0.01)
Contract experience	-	0.01 (0.01)	0.01 (0.00)*	0.01 (0.00)**
Distance	-	-0.02 (0.01)	-0.02 (0.02)	-0.02 (0.01)***
Management support	-	0.02 (0.01)	0.02 (0.01)*	0.02 (0.00)***
Division				
2	0.06 (0.01)***	0.08 (0.02)**	0.06 (0.02)**	0.06 (0.02)**
3	-0.01 (0.01)	0.01 (0.01)	0.02 (0.01)	0.02 (0.01)
4	-0.01 (0.01)	0.00 (0.02)	-0.00 (0.02)	-0.00 (0.02)
5	0.01 (0.01)	0.04 (0.04)	0.01 (0.03)	0.01 (0.03)
Constant	-5.58 (1.78)**	-5.44 (1.10)***	-8.34 (0.84)***	-8.21 (0.60)***
R-squared	0.651	0.694	0.735	-

Number of Obs.	100	100	100	100

Note: Dependent variable is green tea leaves production (kg/week). The dependent variable and two input variables (labor and tea bushes) are in a natural logarithm. They are estimated by OLS. Robust standard errors clustered at the division level in parentheses. *** significant at 1% level, ** significant at 5% level, and * significant at 10% level.

5. Discussion, Conclusion and Implications

One of this study's objectives is to analyze whether CF of the selected tea estate is doing justice to tea estate female farmers by equally treating them with no discrimination in resource allocation. The main reason for this investigation is, females' role is considerably depressed due to the work burden by the male-dominant work practices in employment in the traditional estate labor-management system (Dishanka & Ikemoto, 2014). Moreover, the equity is not maintained in the payment of wages for the work done by females in the traditional system. Although findings of different research have proven multiple realities, this study has revealed the existence of gender equality in performance (output) and earnings (income). In this sense, the CF system seems to eliminate any discriminative practices in the tea estate sector. Moreover, such elimination would enhance the overall benefits that can be gained from the gender diversity of a workgroup. This finding further emphasizes the equalization of earning opportunities provided by the CF system to all the members of a communal group to ensure socio-economic justice. However, equitably allocating resources does not promote discrimination as it ensures optimal allocation of resources for economic efficiency, which would ultimately affect the performance, positively.

Importantly, we need to distinguish the concepts of efficiency in an economic sense from human development orientation. Efficiency in the human development paradigm refers to the optimal use of existing resources to expand individuals' capabilities in the communities. However, this study dealt with economic efficiency because it has been the central issue in the tea plantation sector in Sri Lanka, where tea lands are idled due to the severe shortage of labor. Such an optimal allocation of resources is fundamental to ensure the economic sustainability of this economic activity. Accordingly, the efficiency in resource allocation in the CF system would be Pareto optimal, given that the resources are fully utilized. The production efficiency in CF was assessed using the neo-classical Cobb-Douglas production function to identify the impact of gender on output elasticity of labor and tea bushes. The results show that the output elasticity of tea bushes is significantly lower for female farmers than male farmers. It indicates that tea bushes should be allocated to male farmers more than female farmers to increase the CF system's total output. Allocating more tea bushes to males than females and obtaining much higher output is possible for various reasons.

One is, male workers are more physically capable than females in handling more tea bushes. Another is, males have more idle time in their estate duty roster whereas females have to be fully involved in estate work and household activities as well. Other than the above, usually, males are much more motivated than females in earning additional income. However, such allocation would not affect the opportunities available for women until the abandoned tea lands are fully utilized. The analyses for gender equity (Table 6 and Table 7) and gender efficiency (Table 8) have been regressed with division dummies as well. Although all five divisions are gender-neutral for harvest and income of CF (Table 5), only Division 2 has shown a significant difference from Division 1 (the base division) in all four models of the production function. However, all four divisions have shown varying significant differences from Division 1 with respect to different input and output indicators (Table 6 and Table 7). We have not attempted to further investigate the causes for such differences as gender neutrality of divisions was confirmed beforehand.

Conclusion

The primary reasons for the poor performance in the tea estate sector of Sri Lanka have been known to be the labor shortage and low labor productivity attributed to the existing traditional labor-management system. Hence, a CF system has been introduced to solve the labor shortage and improve labor productivity. In this instrumental explanatory case study, we investigated the CF system's performance in terms of gender equity and production efficiency. Concerning gender equity, the results and findings of this study imply that the CF

system has improved considerably. Since it was inattentive and desecrated in the traditional labor-management system, the CF system seems to be a sustainable solution for the estate community's socio-economic problems. However, for the CF system to be financially sustainable, economic efficiency should be improved at the same time, which requires less equitable allocation of tea bushes between genders. Such allocation could be done according to efficiency criteria which should be determined based on output elasticity. Further, the management should research and review the divisional variances of performance indicators regularly (importantly, Division 2) for possible changes and their causes.

Any significant difference between divisions would provide valuable insights into gender-based resource allocations. The CF system could be introduced as a parallel system with the traditional labor-management system as direct change-over is not feasible. Since each contract farmer is allocated a suitable tea land with a specific number of tea bushes, they can raise their income by gradually increasing their participation. As the CF system promotes both freedom and gender equality, it empowers estate workers to participate as entrepreneurial farmers, who independently manage a plot of tea land with a certain amount of bushes by employing laborers and other inputs (such as fertilizer and chemicals) to earn a profit (net income). This transition of estate workers would uplift independent behavior, strengthening their agency aspects in their socio-economic endeavors, which is essential in human development. Thus, we conclude and confirm that CF would be a sustainable solution for the chronic socio-economic problems of the tea plantation sector of Sri Lanka. Besides, this CF system needs a proper monitoring mechanism of a regulatory body as informalities may arise with the expansion of this system towards a wider estate community.

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