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FACTORIAL ANALYSIS OF CHALLENGES ENCOUNTERED BY SMALLHOLDER COTTON GROWERS IN ESWATINI

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ABSTRACT: *Cotton is the second most important cash-crop in Eswatini, yet production continues to decline. This study identifies the challenges and solutions for ameliorated productivity. Data were collected through questionnaire-guided interviews from 308 growers and 5 key informants. Descriptive statistics, factor analysis and inferential statistics were applied for data analysis. The production-related challenges include drought, inflators of production cost, lack of credit, poor input and mechanical technology supply, ineffectual cooperativism and low-yielding varieties. Market-related challenges include low prices, monopsony, limited market channels and lack of value addition options. Gender, location, farm size and household size revealed significant effects on production-related challenges at $p<0.01$. Labour, location and age revealed significant effects on marketing-related challenges at $p<0.01$, and $p<0.05$, respectively. Identified solutions include subsidies, credit funding and high-yielding varieties under irrigated-farming. Establishment of stakeholder-inclusive regulatory organ is recommended to address the identified challenges. Further redress of cooperativism is recommended to promote cotton productivity.*

KEYWORDS: cotton production, exploratory factor analysis, smallholder farmers, challenges, perceived solutions, Eswatini

INTRODUCTION

Cotton is a fundamental international trade cash crop (FAO, 2018), contributing to household and nation economic growth (Adam *et al.*, 2015). Besides the production of lint for clothing items, cotton by-products are essential in the production of kitchen oils, livestock feed and fertilizers. Cotton further serves as a strategic cash crop for poverty alleviation and economic advancement for the farming population in hot and dry areas (Hodakel, 2020; Vitale *et al.*, 2011), due to its drought tolerant characteristic. In Eswatini, cotton is the second most important cash crop and contributes significantly to income generation for smallholder farmers and national economic growth (Khumalo and Bimha, 2018).

Despite its economic potential, cotton production is generally encountered by numerous stonewalls that undermine productivity (IPBO, 2017). According to Khumalo and Bimha (2018), Eswatini's cotton industry continues to reflect a decline in cotton production, inducing negative impact on farmers' economic benefit and the textile manufacturing subsector. Recent statistics reveal a drastic declining from 23,000 tons in 1975 (Sikhondze, 1989) to 617 tons in 2017 (Eswatini Cotton Board, 2018). This indicates a 97% drop in cotton production, which imposed a temporary closure of the country's ginnery in 2016. Moreover, the industry experienced a 90% deferment of land under cotton production and 67% decline in the farming populace (Eswatini Cotton Board, 2013). This undercuts farmers' economic benefits, majority of whom are poor. Therefore, this study sought to describe the challenges experienced by cotton farmers in Eswatini, further identifying the perceived possible solutions to the challenges. Unearthing the underlying snags is critically imperative for the development of macro and micro competitive strategies for improved cotton production. Furthermore, the findings are integral for policy adjustments necessary for cultivating an enabling production-marketing institutional environment, ameliorating farmers' income and national economy growth.

LITERATURE REVIEW

Cotton production and marketing dynamics in Eswatini

The advent of cotton production in Eswatini dates back to the colonial era, 1904, produced under large scale by the European settlers (Sikhondze, 1984). Since 1918, when natives started participating in the industry, Eswatini's cotton production system remained modelled by a disintegrated small-scale household farm design. Contrary to the large-scale irrigated South African model (Bennett *et al.*, 2011), cotton production is Eswatini is under rain-fed condition and sometimes incorporated into crop rotations by some farmers. This inculcates low productivity, eroding the advantages of the economies of scale (Anwar *et al.*, 2009). The rainfall uncertainty further abates farm-firm productivity, relegating cotton farming into a low-income and high-risk enterprise (Hlophe and Mavuso, 2018).

The overdue reliance on the conventional hybrid seeds, which have reached the decline phase of their lifecycle (Eswatini Cotton Board, 2018), continues to impose sharp decline in cotton production. Ideally, decline in productivity induces decrease in economic welfare gains, forcing farmers to defer production or diversify to alternatives which were of less economic benefit in the first place. This undermines the fight against hunger and poverty alleviation, introducing retrograded national economic growth. Moreover, low seed productive capacity affects the efficient use of other production inputs, forcing farmers to use more pesticides and fertilizer to the detriment of the environment (Bennett *et al.*, 2004; Khumalo and Bimha, 2018). This downgrades cotton production into an economically and environmentally unsustainable enterprise.

Several studies (Hlophe and Mavuso, 2018; Morse *et al.*, 2005; Vitale *et al.*, 2011) have proved the superior yield potential of Bt genetically modified (GMO) cotton varieties over non-Bt hybrid seeds. Currently, the conventional non-Bt hybrid seed varieties (Alba-1) and the hybrid GMO variety (Alba-2) are used in Eswatini. However,

institutional considerations are still in progress for policy adjustments to enhance the adoption of the GMO varieties that are popularly used worldwide. Notably, the Bt cotton varieties are used in the neighbouring South Africa, institutionalized in 1997 (Gouse *et al.*, 2003). This transformed South Africa's cotton production system into large-scale production model with meaningful revenue. The positive economic impact of adopting cotton GMO technology in South Africa was documented by Bennett *et al.* (2004), highlighting low cost for pest control and high yields that improve farmers' income. Furthermore, the African Centre for Biodiversity advocated for the introduction of the Bt GMO cotton varieties in Eswatini to allow for the improvement of rural livelihoods (Lewis and Masinjila, 2017).

The disintegrated small-scale household production model, as in Eswatini, is typified by heavy reliance on family labour, low capital investment, supressed adoption of technology and low farm output (Lewis and Masinjila, 2017). Labour and technology are essential for farm productivity and economic performance (Mohanasundaram, 2015), in which case lack of investment in this regard undermines cotton production and marketing. The country's average farm productivity was 0.7 tons/ha in 2018 (Eswatini Cotton Board, 2018), compared to 4 tons/ha by the neighbouring South African farmers (Bennett *et al.*, 2011). This reveals the dire need for instituting an enabling environment for improved farm productivity to meaningfully contribute to rural livelihoods through the subsector.

In a bid to revive the cotton industry, the Government of Eswatini introduced a credit stimulus package for input solicitation (Ministry of Agriculture, 2015), to which repayments are structurally due after cotton sales. However, the productivity-decline-factor due to poor seed performance diminishes the potential of the credit revolving fund. This obligates a comprehensive approach towards agriculture-based development programmes in the country. In this regard, the recent report of the Eswatini Cotton Board (2018) cited a deficit for the fund, decrying underperformance. In 2017, the government further instituted a recovery strategy through 17 metric tons of cotton seed that was distributed to farmers. Despite this effort, yields remained far below par compared to the 1990-2003 period. Forbye, the national ginnery remains underutilised, receiving a 1,000 metric tons of cotton compared to its 25,000 metric tons capacity (Eswatini Cotton Board, 2018).

The government, through the Eswatini Cotton Board, regulates cotton market prices. Price provides the ultimate market incentive for farmers, which further acts as a production-pull factor. Specifically, the cotton production scale has been found to be dependent of market price (Bennett *et al.*, 2011). Content analysis of the Eswatini Cotton Board reports reflects a constantly small cotton price incline, from E4.40/kg in 2009 to E6.00/kg in 2018 (E-Emalangeni, the currency of Eswatini). Institution of a round-table inclusive organ with oversight functions of a functional price model development and application has been suggested to ensure win-win conditions for stakeholders (Bennett *et al.*, 2011). This eliminates the top-down approach towards price control, which often creates discontentment among stakeholders due to lack of trust within the value chain.

Although the cotton market is secure for Eswatini growers, through the Eswatini Cotton Board, the cotton industry continues to underperform. Inasmuch as market security is critical in agribusiness, the monopsony conditions erode market incentive for farmers since price is controlled by a sole purchaser. This often rewards low economic benefit to producers (Tschirley *et al.*, 2004), undermining farm productivity.

Challenges of cotton production

Cotton is a key global trade commodity, especially for large producer countries such as China, India and U.SA. (FAO, 2018). However, international cotton production projections reflect a decline for the 2016-2025 production period (FAO, 2018). The worst affected countries include U.S.A., China and Pakistan; with 19%, 17% and 5% drop in cotton output, respectively. This decline was mainly attributed to climate change, snail-paced global demand growth and policy uncertainties. The growing corporate interest in the cheaper synthetic fibre is also expected to undermine global cotton production. The economic impact of this backdrop is anticipated to hit hard on Africa, where the livelihoods of about 100 million people are directly dependent on cotton production (FAO, 2018). The worst cases scenario is projected to engulf West Africa where cotton is the major economic driving force, accounting for 40 - 60 % of gross domestic product in Burkina Faso, Benin, Mali, Chad and Senegal (FAO, 2018). In this respect, government policy interventions are viewed as viable means for stabilizing domestic economic activity (Yssif *et al.*, 2015).

The agro-biological challenges for cotton production include factors such as high temperatures at flowering stage, soil and water related problems and pest and disease outbreak (Dohlman *et al.*, 2019). Bakhsh *et al.* (2005) further highlighted social and financial problems such as lack of investment capital for human resource capacitation, inputs and technology solicitation, and lack of economies of scale due to disintegrated smallholder production. In addition, the use of poor quality inputs such as seeds, fertilisers and pesticides has been recorded by some studies as a serious challenge associated with low cotton productivity (IPBO, 2017; Yssif *et al.*, 2015).

Market environment further presents a unique set of challenges that affect cotton production. Market prices, specifically, are imperative in the creation of market incentive that pulls investment into the production process. However, the fluctuation of cotton prices imposes a negative effect on cotton production (Anwar *et al.*, 2009). Moreover, the control of prices by third party forces smallholder farmers to succumb to lower shares of the final commodity value (Bennett *et al.*, 2011). In such cases, smallholder farmers give up specialized farming for diversification, which induces fluctuations in production and market prices.

The lack of specialization is another challenges for cotton production in some African countries, where cotton competes for the same land with other crops (Yssif *et al.*, 2015). Although crop rotation relates well with environmental sustainability, unstable cotton market supply induces price fluctuations which creates market uncertainties and gives room to cheaper synthetic substitutes (Baffes *et al.*, 2004). This further promotes the establishment of large-scale production market ties that jeopardise the integration of smallholders into functional value chains.

METHODOLOGY

Study Area

The study was conducted in the Kingdom of Eswatini, a small country of 17,364km^2 in Southern Africa. The populace is about 1.2 million, out of which almost 70% sustain livelihoods through rain-fed agriculture in rural areas (Vulnerability Assessment Committee, 2015). Based on elevation, landforms, geology, soils and vegetation, the country is classified into four agro-ecological zones (Highveld, Middleveld, Lowveld and Lubombo). Cotton is predominantly grown in the dry eastern zones, Lowveld and Lubombo (Eswatini Cotton Board, 2018). The cool and wetter Highveld and Middleveld are mainly used for edible crop and livestock production.

Recent reports indicated a 63% national poverty rate (Central Statistics Office, 2010) and unemployment rate above 40% (Ministry of Labour and Social Security, 2013/14). Considering the impact of the Covid-19 pandemic, the unemployment rate is expected to surge due to the negative effects experienced by the manufacturing subsector. This calls for a vibrant agriculture sector, which generally provides livelihoods security for many people.

Sampling procedure

Besides the cotton growers, the data were collected from 5 key informants, representatives of the Eswatini Cotton Board, Eswatini Cotton Ginnery, Sambulelo Sakotini Farmers' Association, Eswatini National Agricultural Union and the Ministry of Agriculture (Extension Department). The inclusion of these stakeholders was integral in the development of a comprehensive analysis approach of the cotton industry. In order to identify challenges encountered by growers, the Slovin's formula was applied to the population of cotton farmers (N=1,333) to determine the sample size (S=308) as follows (Yamane, 1967):

$$S = \frac{N}{1 + Ne^2} = \frac{1{,}333}{1 + 1{,}333(0.05)^2} \approx 308$$

Where: *S* is the sample size; *N* is the total number of cotton growers; and *e* is the level of precision set at 0.05.

Simple random sampling was then applied to select the respondents from the population. Judgemental purposive sampling was further utilised to select the 5 key informants to provide supplementary information for a comprehensive outlook analysis of the challenges encountered within the cotton industry. Judgment purposive sampling is an integration of non-probability sampling techniques deliberately applied in the selection of research participants based on the researchers' knowledge about their expertise to elucidate specific concepts, themes and phenomena (Etikan *et al.*, 2016). The method is suitable when specific information is sought from knowledgeable individuals in the field of interest (Tongco, 2007), allowing for accuracy in data collection.

Data collection and data analysis

Data were collected through face-to-face interviews, guided by a structured questionnaire. Face-to-face interviews allow for clarifications in cases of illiteracy and numeracy problems among respondents (Gill *et al.*, 2008), enhancing high response rate and accurate data collection (Doyle, 2014). Two different questionnaires were used, one for cotton farmers and the other for key informants. The farmers' questionnaire was divided into three sections, Section I for Socio-economic Characteristics, Section II for Production-Marketing related challenges, and Section III for Possible Solutions. The stakeholders' questionnaire was divided into two parts, Part A for Challenges within the cotton industry, and Part B for Possible Solutions. The lists of challenges and possible solutions were developed from literature. A five-point Likert agreement scale (1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree) was used for rating the challenges and solutions in both questionnaires. Furthermore, open-ended questions were included to allow respondents to add more information in both questionnaires. The data were collected in July to August 2019. Out of the 308 questionnaires, 305 farmers were usable after eliminating incomplete questionnaires.

The study applied descriptive statistics (means, frequencies and percentages) and inferential statistics (*t*-test and ANOVA) to analyse the data. In view of the long list of literature identified challenges, exploratory factor analysis was applied as a systematic data reduction methodology to draw meaningful conclusions. This method creates composite dimensions or variates called factors that capture the underlying constructs and patterns for meaningful exposition (Hair *et al.*, 2014). The technique extracts maximum common variances from all variables, fusing them into a common score. The demographic-based statistical significant differences on challenges were tested through the independent *t*-test and ANOVA, using the generated factor scores. This allows for understanding variation in perceived problems according to farmer and farm demographics, enhancing specific recommendations according to the different clusters of growers and farms. The data analysis tools were run through Statistical Package for Social Sciences (SPSS) software, Version 22.

RESULTS AND DISCUSSION

Descriptive analysis based on farmers' socio-economic characteristics

Table 1 presents the descriptive statistics for farmers' socio-economic characteristics. The results depict a near balance in the gender within the sample, 52% females compared to 48% for males. The finding is contrary to the common norm that males dominate in agricultural enterprises (Adam *et al.*, 2015; Dlamini, 2020). This reveals cotton production to be an indispensable strategic tool for gender-inclusive rural economic development.

Age indicates that the youth population (≤ 35) within the sample was very low, accounting for a meagre 4%. The older population (≥ 56) of farmers accounted for 49%, with a sizeable 47% being middle-aged (36 – 55years) farmers. This indicates that the cotton farming population is fairly old, which is a global challenge raising a dire need for young farmer campaign programmes (May *et al.*, 2019; White, 2012). The results further indicate that most cotton farming households (148 – 49%) have smaller

household sizes. Since rural agriculture in Eswatini is heavily dependent on family labour (Sikhondze, 1984), the results allude to low labour supply for cotton production, justifying the small-scale production system. Only 23% of the sample have larger household sizes. A huge proportion of the sample, 71%, have farming experience greater or equal to 7 years. This indicates that farmers are probably conversant with the cotton production process.

Table 1. Descriptive statistics for farmers' demographic characteristics (S=305).

Variable	Categories	Frequency count	Percentage frequency
Gender (sex)	0 = Female	158	51.8
	1 = Male	147	48.2
Age (years)	0 = ≤ 35	11	3.6
	1 = 36 – 45	39	12.8
	2 = 46 – 55	105	34.4
	3 = ≥ 56	150	49.2
Household size (number)	1 – 3	148	48.5
	4 – 6	86	28.2
	≥ 7	71	23.3
Experience (years)	4 ≤	26	8.5
	5 – 6	63	20.7
	≥ 7 years	216	70.8

Table 2 presents descriptive statistics for farm and farming related demographic characteristics. Cotton farming is practised in the eastern parts of Eswatini, in the Lubombo and Shiselweni regions that are predominantly Lowveld epitomized by hot and dry climatic conditions and highly susceptible to recurrent droughts. This prevents the growth of high moisture growing crops, hence, the sample was composed of 88% of farmers from these regions. The results also show that cotton production is heavily reliant on family labour, 58%. This is common under small-scale household farming systems in developing economies (Adam *et al.,* 2015). Labour is crucial for increased farm output, therefore, the results allude to small portions of land allocated for cotton production.

Table 2. Descriptive statistics for farm and farming related characteristics (S=305)

Variable	Categories	Frequency count	Percentage frequency
Farm location (region)	0 = Lubombo	198	64.9
	1 = Shiselweni	71	23.3
	2 = Manzini	16	5.2
	3 = Hhohho	20	6.6
Type of labour (source)	1 = Family labour	177	58.0
	2 = Hired and family labour	128	42.0
Production consistent	1 = Yes	77	25.2
	2 = No	228	74.8
Seed variety (name)	0 = Alba-1	119	39.0
	1 = Alba-2	186	61.0
Farm size (ha)	1 = ≤ 2	244	80.0
	2 = 2 – 4	50	16.4
	3 = > 4	11	3.6

The results further reveal that 75% of the sampled farmers are not committed to consistent cotton production. This induces inconsistent cotton supply to the market, injecting price fluctuations and allowing room for cheaper synthetic cotton substitutes. Moreover, inconsistent market supply encourages large-scale producers to inherit more market share, which eventually relegates smallholders from agricultural markets. In such cases, even institutional efforts of integrating smallholders into pro-poor value chain become jeopardised, leaving smallholder farmers without competitive marketing strategies. The results also indicate that the farmers use the Alpha hybrid cotton seeds, with 61% planting Alba-2 compared to 39% that use the Alba-1 variety.

As inferred by the reliance of growers on family labour, yet most farming households having smaller family sizes, the results indicate that 80% of the sampled farmers produce cotton on land sizes smaller or equal to 2 hectares. Table 3 confirms that the land size allocated to cotton production (Average ≈ 2ha) is less than half (40%) of the total land area owned by each farmer. The historical outline of cotton farming in Eswatini by Sikhondze (1984) captures infinitesimal scale production of cotton as a challenge dating back to the colonial era.

Table 3. Cotton land allocation to total farm size in hectares (S=305).

Variable	Mean	Std. Dev.	Min	Max
Arable land owned by farmer	4.715	2.455	1	20
Land allocated to cotton production	1.890	1.130	0.25	10

Descriptive analysis of reported challenges

Table 4 shows the mean ratings by respondents based on the 5-point Likert agreement scale. The average, 2.5, was set as the judgement criteria for identifying major challenges. Challenges related to market price and drought indicate high means, thus, ranked 1st and 2nd. The results are similar to the findings by Masuku *et al.* (2016). Several studies have also identified low and fluctuating cotton market price to be the major challenge confronting the cotton industry (Bennett *et al.*, 2011), together with adverse climatic conditions (Hlophe and Mavuso, 2018; Mert, 2005; Ünlü *et al.*, 2011).

Several other possible challenges were identified in the cotton industry. These include high production cost due to high input and transport costs. High production cost diminishes farm revenue, rendering cotton farming less lucrative (Masuku *et al.*, 2016). Farmers also reported difficulty in sourcing production inputs, since the Eswatini Cotton Board is distant from most cotton farming households. Moreover, pesticides are often not available at the time of need. Monopsony, one-buyer market, also indicates to be a major challenge for farmers. This erodes market competition which is critically vital for the price setting mechanism. Currently, growers market their cotton to the Eswatini Cotton Board, which in turn sells the lint and cotton seeds to South African companies. The monopsony challenge further creates the one-market channel system, which exhibits numerous demerits such as undiversified value addition options.

Table 4. Summary statistics for challenges in the cotton industry (S=305).

Variable	Mean	Standard Deviation
Low cotton price	4.311	0.850
Drought	4.295	0.846
Lack of value addition options	3.879	0.878
High input cost	3.862	1.023
Scarcity of inputs	3.830	1.031
Limited marketing channels	3.830	0.883
Monopsony	3.797	0.895
Lack of loans and credit schemes	3.715	0.904
Ineffectual farmer's associations	3.682	0.896
High transport cost	3.492	0.939
Type of hybrid cultivated	3.416	1.209
Lack of labour	3.197	1.115
Competition from other crops	2.620	1.100
Insufficient training	2.377	1.243
Loan defaulting	2.367	1.199

Lack of suitable farm credit schemes was rated as a challenge within the cotton industry. This is a common problem abating production efficiency within the agriculture sector (Ayaz and Hussain, 2011). Although the government input supply funding mechanism is appreciated, growers are often left with insufficient funds to cover other costs such as tractor hire. The results further reveal ineffectual farmer's association to be another important stonewall towards competitive performance. As indicated by Dlamini and Huang (2019a), cooperative resilience is a serious challenge for Eswatini's agricultural co-operative movement. This undermines farmers' productive capacity and bargaining power, reducing farmer's economic benefit from the cotton enterprise. The Alba-2 seed variety was said to be high yielding compared to the Alba-1, however, it produces lighter lint, diminishing growers' income. Lack of labour was indicated to be a challenge for farmers since hand-picking is the common harvesting method, inducing harvest losses and reducing farmers' economic benefit. Competition from other crops revealed the least mean rating, because most crops do not grow well in the eastern part of the country where cotton is produced.

Factorial analysis of challenges

Preliminary analysis

Factor analysis provided a systematic mechanism for the organisation of the numerous identified challenges (variables) into fewer factors for consolidated synthesis. The preliminary analysis revealed 2 outlier variables that were dropped, leaving a total of 13 variables for further analysis. The analysis yielded a KMO (0.85) that was greater than the critical value (0.50). The KMO measures the adequacy of data that is used and specifies the variance proportion in the variables that may be caused by underlying

factors (Hair *et al.*, 2014). The Bartlett test of sphericity revealed statistical significance at $p = 0.000$, indicating appropriateness of the dataset for factor analysis.

Factorial analysis

The principal component analysis (Table 5) was rotated through the Varimax method with the Kaiser normalization, allowing for better interpretation of the results. Factor loadings < 0.4 were rejected, thus 2 factors were identified. Factor-1 was composed of 10 variables, while Factor-2 had 3 variables. Based on the consolidated pattern analysis of variables in the variates, Factor-1 was labelled "Production-related Challenges", while Factor-2 was labelled "Market-related Challenges". The reliability test for internal consistency within factors was assessed through Cronbach's alpha values, which were 0.836 and 0.831 for Factors 1 and 2, respectively. These alpha values are > 0.7, hence acceptable for further analysis (Gliem and Gliem, 2003).

A synthesis of the results reveals that the production-related challenges can be grouped into capacity and access to direct input, inflators of production cost, use of low-yielding varieties and insufficient loan and credit support for farmers. Capacity to access production inputs is centred on dismantling barriers to capital access. Generally, smallholders cotton farmers are poor, lacking investment capacity into production processes. Moreover, the lack of a decentralised input supply services system inflates production cost, reducing economic benefit from cotton farming. This requires cultivation of enabling institutional environment. Notably, the government-aided revolving credit fund must be re-packaged to be a sufficient source of capital. The often less resilient cooperated production-marketing system should re-addressed to development of farmers' capital capacity to meet production cost, improving farmers' bargaining power and promoting integration into functional pro-poor value chains (Dlamini and Huang, 2019b). Withal, the use of high-yielding varieties must be instituted to enhance productivity and consistent market supply, curbing price fluctuations. Such GMO Bt varieties have been already adopted by many countries (Bennett *et al.*, 2004; Masuku *et al.*, 2016).

Table 5. Rotated component matrix.

Variable	Factors		Cronbach's alpha
	Production-related	Market-related	
High input cost	0.719		0.836
Insufficient training	0.712		
Type of hybrid cultivated	0.675		
Scarcity of inputs	0.664		
Competition from other crops	0.644		
Lack of labour	0.627		
Loan defaulting	0.590		
Ineffectual farmers' associations	0.508		
Lack of loan and credit schemes	0.503		
High transport cost	0.411		
Monopsony		0.932	0.831
Lack of value addition options		0.923	
Limited marketing channels		0.635	

Effects of demographic characteristics on perceived challenges

Table 6 presents the independent *t*-test and ANOVA analyses results, indicating the demographic group variation in relation to the identified variates. The factor scores for each variable in the two factors were used as the dependent variables and farmers' demographic characteristics were applied as the grouping variables. The factor scores were obtained through the Bartlett procedure to keep the factors orthogonal.

The results indicate gender significant differences regarding Factor-1, revealing that production-related challenges are more of a challenge for females than males ($Mean_{Female} = 3.402, Mean_{Male} = 3.1119, p < 0.01$). This implies stronger support need for females than males. Farmers in the Manzini region rated production-related challenges to be more important than farmers in other regions ($Mean_{Manzini} = 3.900$). This induced significant spatial effects on cotton production, insinuating that production-related challenges are severe in the Manzini region compared to other regions. Further enquiry is required to underscore the reason behind the results.

Farmers with larger farm sizes (> 4ha) rated production-related challenges to be less serious compared to farmers with less hectarage. This captures the advantage of economies of scale in reducing production cost and other production challenges, inducing significant differences regarding farm size at $p < 0.01$. The results advocate for a shift towards larger scale production to minimise production-related challenges such as production costs. It is worth mentioning that the finding is in line with the 2018 gross margins that indicate that farmers interested in cotton production are advised to produce on large scale for optimum profits and benefit from economies of scale (Ministry of Agriculture, 2018). Household size depicts farmer's labour capacity to handle farm work and the use of other production resources. The results indicate that smaller households reported production-related challenges to be more significantly important compared to larger households at $p < 0.01$.

Table 6. Effects of selected demographic characteristics to the variates (S=305).

Variables	Farmer Feature	Measure	Mean Rating	Mean Loading	F/*t*-value	Scheffe
Production-related	Gender (sex)	0=Female	3.402(1.000)	-0.184(1.03)	3.373***	
		1=Male	3.119(1.102)	0.196(.093)		
	Area (region)	0=Lubombo	3.228(1.074)	-0.009(0.99)	6.149***	2>0>1
		1=Shiselweni	3.144(1.069)	-0.236(1.02)		
		2=Manzini	3.900(0.805)	0.889(0.80)		
		3=Hhohho	3.410(0.902)	0.218(0.74)		
	Farm size (ha)	1=≤2	3.277(1.044)	0.052(0.98)	4.884***	1>3<2
		2=2-4	3.268(1.096)	-0.060(1.00)		
		3=>4	2.718(1.232)	-0.888(1.09)		
	Household size (number)	0=1-3	3.422(1.039)	0.230(1.03)	8.283***	1<0>2
		1=4-6	3.070(1.030)	0.273(0.89)		
		2=≥7	3.195(1.128)	-0.149(0.97)		
Market-related	Area (region)	0=Lubombo	3.741(0.934)	-0.125(1.04)	3.476**	1>0
		1=Shiselweni	4.000(0.790)	0.264(0.93)		
		2=Manzini	4.292(0.738)	0.363(0.91)		
		3=Hhohho	3.817(0.602)	0.007(0.54)		
	Age (years)	0=≤35	3.812(0.859)	0.044(1.43)	3.482**	2>1
		1=36-45	3.521(0.800)	-0.352(1.27)		

	2=46-55	3.994(1.047)	0.215(0.87)	
	3=≥56	3.757(1.121)	-0.060(0.95)	
Labor (source)	1=Family labour	3.967(0.812)	-0.122(0.99)	2.525***
	2=Hired and family labour	3.278(1.441)	0.169(0.99)	

** $p < 0.05$, *** $p < 0.01$. Standard deviation in parenthesis.

Farm location also revealed significant differences ($p < 0.05$) regarding the Factor-2 (market-related challenges). The results reflect that farmers in the Shiselweni region are more challenged by market-related challenges compared to those in the Lubombo region, significant at $p < 0.05$. The Shiselweni region is relatively distant and remote from urban markets and as well as the cotton ginnery. This imposing institutional market challenges for farmers, inflating the costs of production and logistics. The results indicate a strong need for a decentralized service provision mechanism that enhances easy access to product and input markets. The category of farmers aged 46 – 55 revealed significant difference ($p < 0.05$) with those aged 36 – 45. There is need for further analysis to reveal the underlying reasons behind the lower mean rating for farmers aged 36 – 45 years. Significant difference, at $p < 0.01$, is observed regarding the type of labour used by farmers. Farmers using family labour reported market-related challenges to be more serious for them compared to their counterparts that use the combination of family and hired labour.

Other challenges

Additional challenges cited by the farmers include the lack of equipment for soil preparation soon after the first rains, leading to delayed planting. Late planting is a bad husbandry practice that exposes crops to peak pest and disease periods when cotton plants are still young without sufficient resilience. This is critical for the productivity of the conventional varieties, which are highly susceptible to pest and disease attack. The lack of motivational factors such as farmer awards resounded among farmers. Such awards are common in other crop enterprises like maize production, providing lucrative rewards (tractor and implements) to farmers. This provides incentive for improved productivity and rural development.

Farmers further reported the lack of harvesters which inflates the production cost, deflating farm-firm profits. In this case, farmers resort to cotton hand-picking during harvesting, which induces harvesting losses. Moreover, the free range livestock production system in Eswatini allows animals to roam into cotton field, destroying the cotton crop. The lack of sufficient funds deprives farmers the capacity to secure strong and reliable fence barriers to protect the cotton crop. Lastly, farmers indicated that the Alba seed varieties are often of poor quality, sometimes forcing them to replant due to poor germination. This further increases production cost and undermines production, discouraging farmers.

Generally, the key informants' views were in line with the ratings from farmers. However, variation was noted regarding competition from other crops on cotton production. Cotton production is one major substitute cash crop for edible crops and other high water demanding cash crops. Therefore, even if farmers would like to grow

popular crops like maize, it would be impossible because of the lack of water supply. Hence, competition from other crops should not a serious problem.

Possible solutions to challenges

Table 7 presents the descriptive statistics for the identified possible solution to the challenges within the cotton industry. Government support through subsidies was rank highest, to promote farmers' capacity to solicit production resources. Direct cotton subsidies in Eswatini were absent since the era of critical slumps in 1929-1931, undermining farmers' efforts and interests (Sikhondze, 1984). The farmers' lack of financial capacity to service loans sourced from the government aided credit scheme reveals the need for subsidy support to sustain cotton production in Eswatini. Tschirley *et al.* (2004) highlighted that governments have applied subsidy programs to revive struggling agricultural subsectors, to which such programs are withdrawn once stability is achieved. Moreover, the inability to mitigate production deflators supresses economic benefit from the enterprise, rendering cotton production non-profitable. This necessitates further government support through subsidies (Ghambi, 2015).

Suggestions related to the irrigated farming using high-yielding varieties obtained the 2nd and 3rd rankings. High-yielding varieties allow for improved farm output (Bennett *et al.*, 2011), leading to improve farmers' income and livelihoods. This improves farm production efficiency, promoting efficient use of other invested inputs and cutting down the production cost (Morse and Mannion, 2009). Otherwise, increasing the input base without selection of high-quality-yielding varieties undermines efficient use of investment. The construction of water reservoir and introduction of irrigated seed varieties enhances cotton production (Tilahun *et al.*, 2011).

Table 7. Summary statistics for perceived solutions to challenges (S=305).

Variables	Mean	Standard Deviation
Government intervention (subsidies)	4.269	0.568
Practice both dry and irrigated cotton cultivation	4.239	0.668
Introduction of cotton GMO seed varieties	4.111	0.943
Capacitation on cooperative leadership	4.007	0.562
Establishment of suitable credit schemes	3.954	0.701
Encourage private companies into the industry	3.718	0.888

Capacitation on cooperativism and cooperative leadership is imperative in advancing cotton productivity and financial performance (Zwane *et al.*, 2002). This allows farmers to share production and marketing risks, and creates bargaining power for input solicitation and securing functional market channels. Farmers' association are also renowned for building farmers' resource base, through pooling of resources such as funds, skills and so on (Dlamini and Huang, 2019a). This is also essential in reducing the need for expensive huge loans.

The farmers also suggested re-packaging of the current credit fund in a manner that allows for meaningful farm investment. The input-supply-based loan system leaves farmers without funds for other production costs such as tractor hire, transport costs and

so on. Lastly, farmer suggested the encouragement of private companies to enter into the cotton industry. This will support farmers' timely access to production technology, which can further allow for the establishment of multi-market-channel system, creating healthy market competition.

Other possible solutions

Further possible solutions include the introduction of grower bonuses by the ginnery. Such bonus strategy has been applied successfully in Eswatini's sugar cane production industry, providing an entrance and productivity incentive for farmers. Unlike edible crops that are mainly produced under subsistence conditions, cash crops such as cotton and sugar cane are basically for business purposes. Hence, monetary reward is supreme and the driving incentive for production. Moreover, farmers' competitions are also suggested as means of improving quality farm output. At the ginnery, cotton is graded according to quality, which could be the basis of establishing such motivational rewards.

The control of livestock, which destroy the cotton crop on fields, is fundamental in reducing farm losses. The institutional environment requires the institution and enforcement of functional policies that create win-win conditions for both cotton and livestock farmers. Finally, access to market information is imperative to stimulate increased production, especially during market price increase scenarios. Moreover, access and ability to use market information is integral in agribusiness, allowing stakeholders to develop competitive production-marketing strategies and to establish functional value chains.

The qualitative analysis of key informants' views on improving the vibrancy within the cotton industry revealed emphasis of government subsidies. These stakeholders realise the lack of financial capacity among farmers, which diminishes the farmers' potential and willingness to pursue supreme cotton productivity. The informants also recommended farmer support irrigation programmes to mitigate the effects of climate change. This indicates strong need for an inclusive stakeholder regulatory organ, mandated to develop, institute and monitor a cotton production-marketing development framework. This would create organisation and cohesion within the cotton industry, allowing for cooperated efforts towards addressing the existing challenges within the production and marketing space. Furthermore, cooperated value chain management would create transparency regarding pricing, thus promoting cooperation in the fight against rural poverty (Bassett, 2010).

Implications for Practice and Policy

The synthesis of the finding indicates that farmers are encountered by numerous production and marketing challenges. Inasmuch as the agriculture sector is heavily challenged, farmers bear strong desire to develop competitive mitigation strategies to pursue cotton production. Farmers should engage in capacity building on cooperativism and cooperative management and leadership to enhance cooperated production and marketing of cotton. There is need for the Cooperative Development College to redress cooperativism as a functional model for economic growth, applying pragmatic skills

transfer methods for the exposition of the socio-economic merits of cooperative-based development programmes in the agriculture sector.

Policy-wise, the cultivation of a functional institutional environment emerges as a primary mechanism for improved performance of the cotton industry. Institution of an inclusive management and regulatory body must be implemented to develop a turn-around strategy that focuses on creating farmers' motivation and financial support. Establishment of irrigated cotton farming system with the use of high-yielding varieties is also essential for improved farm productivity. In this regard, the Eswatini Cotton Board and farmers' apex cooperatives are at pole position to initiate and aid in the implementation of the study recommendations.

Further Research

Further empirical analysis on production efficiency is integral in the improvement of farm output without increasing the input base. Further research is also required in identifying and addressing the hindrance of access to farm credit and cooperative performance. Farm credit and cooperativism are vital in advancing farm productivity, thus, ameliorating farmers' income and livelihoods. Addressing the determinants of cotton production is also imperative in understanding the underlying drivers of productivity.

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