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Challenges and Prospects of Sericulture in Ghana: Review

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ABSTRACT

Diversifying economic practices to the growth of every local economy cannot be overstated. However, since its inception in 1992, sericulture development in Ghana has experienced appreciable turbulence, which seems to have dwindled the industry's growth. This study seeks to review the impact of sericulture on some emerging economies and juxtapose it with the current state in Ghana. Given this, an empirical review of the state and impact of sericulture globally was looked at in relation to our local experience as a country. With keywords including silk production, sericulture, silk industry, Ghana, and challenges, 186 documents were obtained initially from the Scopus online database. Further inclusion and exclusion criteria were applied to obtain 74 studies which were included in the analysis. Given this, an empirical review of the state and impact of sericulture globally was looked at in relation to our local experience as a country. As a result, it was found that sericulture production in emerging economies such as India has contributed significantly to creating employment, alleviating poverty, and propelling the country's economic growth. In contrast, in Ghana, sericulture has not developed as expected due to general neglect of the textile subsector by succeeding governments in terms of policy direction and financial investment. The industry is comparatively younger in Ghana, and there is great potential for growing mulberry plants and rearing silkworms due to favourable environmental conditions and labour availability.

Keywords: *Sericulture, Diversity, Silk Industry, Prospects, Poverty, Economy.*

INTRODUCTION

Successive government regimes in Ghana have made frantic efforts to migrate the country from the static-dependent behaviour of the economy onto a more diversifying one on commonly known avenues such as timber, cocoa, gold, etc. (Amano, 2021). However, many attempts to see this become a reality have proven unsuccessful, owing to less attention and ineffective policies. Sericulture, though not completely a new venture on the country's economic front, is apparent to focus on how other African, Asian and European countries have achieved their heights and replicated same or similar to improving the state of its practice in Ghana (Hifza, 2020).

Sericulture, an art and science-based venture is an emerging area that seeks to address key economic expectancies (Hifza, 2020). Also known as silk farming, sericulture is the cultivation or practice of cultivating silkworms to produce raw silk. Gangopadhyay (2009) affirms that sericulture is a farm-based art and science activity that involves intensive labour in

raising silkworms for silk yarn production. Evidence of silk cultivation could be dated as far back as 2700BC, as the discovery of ceramic pieces looking like silkworms was established to indicate the long-term practice of sericulture in parts of Asia (Barber, 1992). Good et al. (2009) add that analysis conducted on archaeological silk fibre indicated the existence of the practice in the Indus civilisation as far back as 2450-2000 BC. Bombyx Mori, though one of the many silkworm species, is the sericulture fraternity's most widely used and known worm (Arunkumar et al., 2006).

It is estimated that 70% of the global population live in rural areas with absolute poor conditions. Solving these requires resolute policies and appropriate technologies to improve agriculture-oriented activities (Dewangan et al., 2011). Sericulture is one of the surest ways of alleviating poverty since it requires low investment but gives higher returns on investment in a very short period. Several studies have affirmed that sericulture requires a low investment venture, which suits many low-income rural folks to engage in agriculture and sericulture with the potential to earn higher returns to improve their livelihood (Hiware, 2016; Naik, 2017). It has been proven that wild silk production may be a more effective conservation and poverty alleviation tool in developing countries where governments are unstable and people are chronically poor (Craig et al., 2012; Kasi, 2013).

Moreover, the sericulture business yields regular income on an equity basis, where the individual and community benefit without bias in creed, gender, or religion. In this light, several opportunities are created for eventual social, economic, and political independence (Geetha and Indira, 2011). By inference, sericulture can serve as a panacea for individuals and communities living in extreme poverty to gain economic liberty due to the low initial investment capital and expertise required.

The need to venture into such a society-transforming business has been proven by sericulture production in China, India, Uzbekistan and other Asian countries. Such growth has been necessitated by constant but essential technological practices, which they progressively uphold. On the contrary, Ghana remains a beginner in this prospective venture. Even though the country has been in practice for over two decades already, not many positive trends could be aligned with its practices, not to mention the impact on the Ghanaian economy. The country has been using this practice for almost three decades, and available data cannot boast of the enormous positive effect of sericulture on individuals, families, and the country. For instance, many initial set-up farms in many parts of the country have collapsed. More than expected, challenges relating to climate, financing, technological know-how, and other factors have completely engulfed the development of sericulture in the country.

Again, the above has subsequently led to no impact on the socio-economic life of the people. Rural folks continue to live in extreme poverty with no or less to feed on. Farmers are still glued to orthodox farming practices that contribute averagely less to their impoverished lifestyle, without access to other lucrative oriented farming practices such as sericulture.

That notwithstanding, unlike elsewhere in Europe and Asia, where markets have been made available to consume the bulk production of eggs, cocoons, mulberry, etc., by farmers, the situation is quite different in Ghana. Production of these is unutilised to their full benefit due to the unavailability of industrial markets that patronise these products and put them into real consumables for users. Consequently, the concerns raised, when addressed, will seek to enhance the growth direction of sericulture production in Ghana. Through this same effort, living standards in the rural zones improve, and migration is reduced drastically, affecting economic growth in

rural areas due to the availability of alternative farming ventures for employment. Also, when many of the poverty-driven communities in the country are connected to sericulture production, returns of yield increase, and the country's economy grows through the manufacture of textile products or exports for revenue.

This review seeks to present the historical perspective and the current state of sericulture in Ghana, the policy direction of sericulture in Ghana, sericulture in the advanced and emerging economies, technological advancement in sericulture, challenges of commercial sericulture production and prospects of sericulture production in Ghana.

METHODOLOGY

A systematic review of the state and impact of sericulture elsewhere in the world vis-a-vis what pertains to Ghana is presented. The search query approach was used in databases (Google Scholar, Web of Science, ProQuest and Pubmed) to obtain published articles and books. To do this, keywords on various subjects of relevance and their related synonyms were used to query the databases. Articles were carefully selected by comparing facts strictly based on our inclusion criteria. Databases of the Ministry of Trade and Industry (MTI), Ghana Investment Promotion Council (GHIPC), and the Ministry of Agriculture were also searched to ascertain the current state of sericulture production and government policy on the sector. The Scopus online database, however, became a major search platform for obtaining data for the analysis of keywords and the publication interest of scholars regarding silk production globally. In the Scopus database, keywords such as silk production, sericulture, silk industry, Ghana, and challenges were used for the search. The search yielded 184 documents with the search block [TITLE-ABS-KEY (silk AND production OR sericulture OR silk AND industry OR Ghana AND challenges)]. The documents comprise 111 articles, 31 reviews, 17 book chapters, 17 conference papers, 5 books, 2 conference reviews, and 1 note. The inclusion criteria were all documents that give related information on the topic under study.

CONTRIBUTING COUNTRIES

The study reviewed the interest of scholars in the area of silk production from inception to date. With the Scopus online database, the top ten (10) contributing countries were analysed to understand the trend of publication country-wise. From Figure 1, the top contributing country is China, with 52 documents, followed by India, with 37 documents. This validates Sashina and Yakovleva's (2023) assertion that silk is produced mainly in Asia, precisely in China and India, among the various countries. The United Kingdom brought Europe to the surface by placing third among the top 10 contributing countries with 17 documents. Again, the United States placed 4th with 14 documents. France and Iran placed 5th position with 7 documents each, whereas Australia and Germany placed 6th with 6 documents each, followed by Japan and the Russian Federation with 5 and 4 documents, respectively. From the interest of researchers in the publication, it could be said that no African country fell within the top 10 contributing countries. This could be attributed to the low silk production in Africa; hence, researchers are reluctant to address it in their studies.

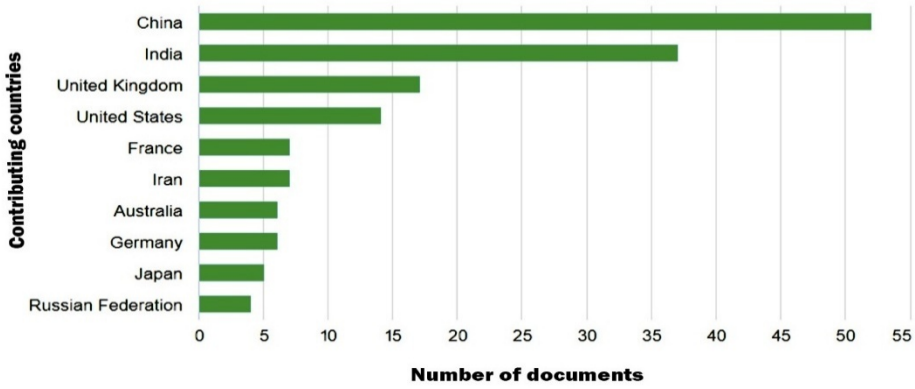

Figure 1: Top 10 contributing countries

KEYWORDS ANALYSIS

Keywords analysis was done using the VOSviewer software with extracted data from the Scopus online database. With the 184 documents obtained through the database search, a co-occurrence analysis was done by setting the minimum number of occurrences of a keyword at 5 using the VOSviewer software. Subsequently, 54 out of 2,043 keywords met the threshold. As presented in Figure 2, the analysis results reveal 5 clusters and 831 links with a total link strength of 1,980. Clusters 1, 2 and 3 have 12 items each, whereas cluster 4 has 10 items. Cluster 5, however, has the least number of items (8).

From the figure, cluster 1 (red clusters) projects *Silk* as the major keyword with 47 links and a total link strength of 149 and 41 occurrences. Also, cluster 2 (green clusters) has *human* as a major keyword with 43 links and a total link strength of 168 and 16 occurrences. The major keyword in cluster 3 (blue clusters) is *silk fibroin,* with 45 links and a total link strength of 184 and 19 occurrences. Again, the 4th cluster (yellow clusters) has *chemistry* as the major keyword, linking 44 items with a total link strength of 164 and 15 occurrences. The last clusters (shown in purple) reveal that the *silk industry* is the major keyword with 7 links and a total link strength of 17 and 15 occurrences. It could be inferred from the analysis that *silk* production around the globe has gained popularity, resulting in the keyword *silk* repeating more than other words in the documents extracted from the Scopus online database as far as sericulture is concerned.

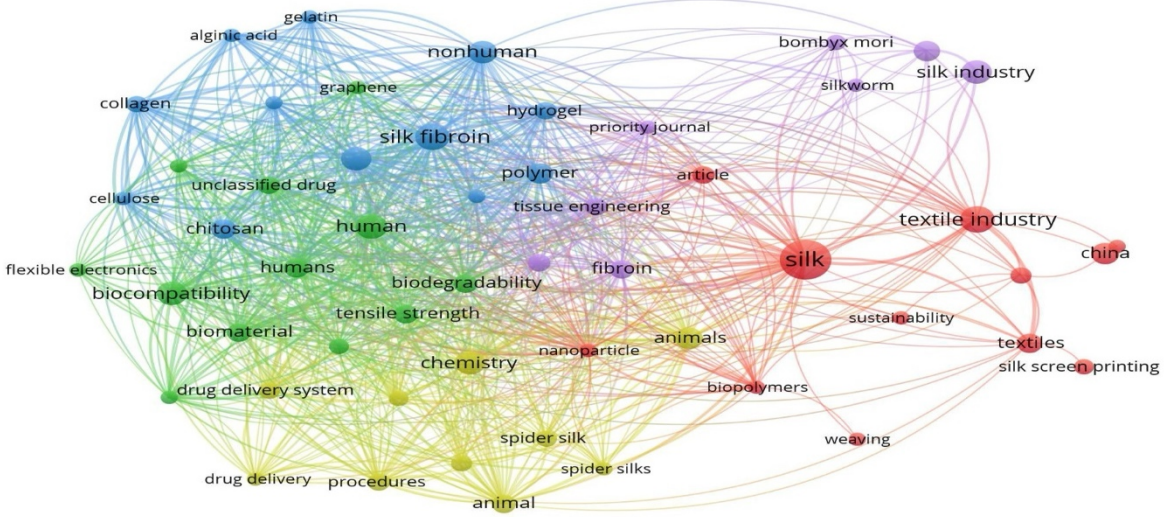

Figure 2: Co-occurrence of keywords

SNIPPET OF GLOBAL SILK PRODUCTION

Throughout the history of textile fibres in human existence, silk, a highly valued fibre, is considered comparably higher within the textile fibre fraternity owing to its outstanding appreciation in terms of consumer preference, unit values, fashion significance, and the socio-economic relevance in terms of employment opportunities, income generation and poverty alleviation from practising communities (Thiripura and Ramalakshmi, 2018). Rajat and Mahesh (2005) assert that demand for high- and medium-priced silk garments continues to rise due to growing concerns by industries and users about environmental protection issues in comparison to chemical fibres.

Asia is the top producer of silk globally, contributing 95% of the total global output, with America and Europe adding a little over 4% globally. According to the International Silk Union Report (2020), although total global production of raw silk seems to have declined since 2015, the average acquisition price for the silk industry has risen by approximately 13%. According to Hifzi (2020), the global demand for silk has grown by 5%. It is worth two (2) billion dollars annually, with China, India, Uzbekistan, Vietnam, Thailand and Brazil being the top six leading countries globally as of 2021. The annual growth and yield testify to higher industrial remuneration for rural folks, which is evident in such populates in India (Paramjit and Vibha, 2011). Figure 3 shows the global production of silk.

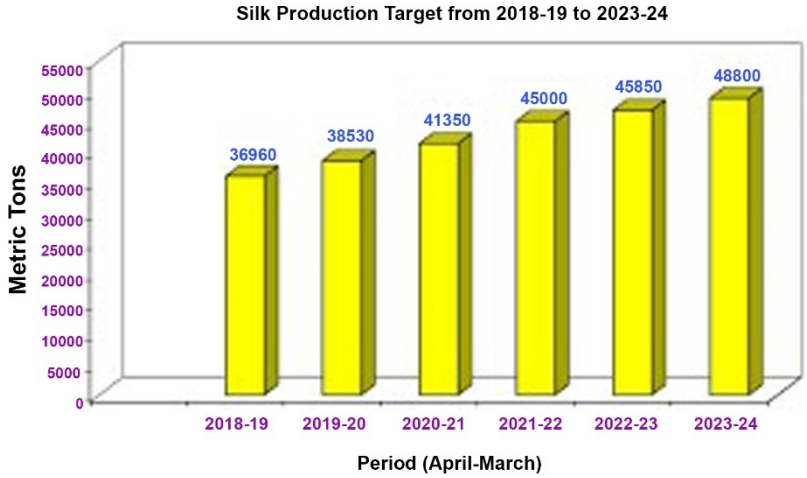

Figure 3. World production of silk
Source: International Sericulture Commission

Raina et al. (2011) opine that about 95-99% of the world's silk is obtained from the domesticated silkworm Bombyx mori L. (Lepidoptera: Bombycidae), whereas wild silk represents an extremely minute percentage.

China's vast silk production originates from the mulberry silkworms (*Bombyx mori*), whereas the less non-mulberry production focuses on wild silk from the Chinese Tussah moth (Puette, 2013). According to the Ministry of Commerce Statistics (2005), China produced 74 - 78% of global raw silk and 90% of the world export market (Jiang, 2021). Due to the effective state policy geared toward the sector's development, the Chinese silk industry has grown in leaps and bounds.

As the home of various silk, over the last decade, India has produced over thirty-thousand (30,000) metric tons of raw silk as China's second most successful sericulture practitioner (Statista Research Department-

India, 2021). India produces five commercially traded varieties of natural silk: Mulberry, Tropical Tasar, Oak Tasar, Eri and Muga. In addition, the bivoltine breed of Bombyx Mori CSR2×CSR4 is an Indian high-yielding silkworm strain (Venugapal et al., 2016). This indicates that over 60% of the world's annual silk production is contributed by China and India (the two leading silk producers worldwide), principally from the Bombyx Mori.

As the leading country in the ASEAN region, Thailand has earned a global reputation for the 503 metric tonnes of attractive and unique silk it produces. The demand for silk products has grown significantly in both domestic and foreign markets in Thailand, with a huge ability to produce silk products from upstream to downstream (Leerojanaprapa and Atthirawong, 2015).

Brazil is among the leading countries in the global sericulture venture and operates largely. It relies on the Bombyx Mori silkworm for its eventual high growth yields in sizeable volumes of raw silk (Alessandra et al., 2017). Furthermore, Uzbekistan employs the Bombyx Mori for their yield, making her a similarly recognisable brand in the venture and the largest cocoon exporter (IndexBox Report, 2022).

Other countries, including France, Italy, Japan, North Korea, Russia, and Vietnam, have practised for many years, with a little over 30% of the world's annual production (Alessandra et al., 2017).

SILK PRODUCTION – THE AFRICAN PERSPECTIVE

According to Harnet (2015), the earliest accounts of sericulture in Africa are dated four (4) centuries ago and primarily aligned to Madagascar. This is because mulberry trees in this area naturally grow for worms to feed on. In the 21st century, Africa has put together valuable strategies as frameworks to deal with the continent's developmental problems (Oksanen et al., 2003). Sericulture and its associated operations, such as silk reeling technologies, are severely immature, with cocoons and silk used as materials for traditional handcrafts that are poorly supplied to the local market (JAICAF, 2007). Annually, Africa contributes less than 1% of silk globally despite being one of the continents with the lowest per capita income and highest unemployment. Currently, Zambia and Uganda are the major practitioners of the venture in Africa, ensuring it will eventually become an economic force (Zambrano-Gonzalez, 2017). According to the International Sericulture Commission (2018), Zambia and Uganda, as well as others such as Egypt, Zimbabwe, Nigeria, and Botswana, are among the countries that produce minute quantities of sericulture worldwide.

In its poverty reduction strategy and 5th National Development Plan Programme, Zambia has emphasised developing the agricultural sector for which sericulture plays a key role as a main frontier and engine of economic growth (Bwalya, 2011). According to the Government of the Republic of Zambia (2002), this remains a strong potential for maximising employment and other related income generation opportunities for the majority of the poor in rural areas.

In affirmation, the Government has aided and released 5,000 hectares of land to the Wonder Group of Companies of China. It has subsequently invested about US$25 million in the cultivation and production of silk in the Mpika district of Zambia, which is estimated to employ over 2,000 people at full capacity (TechWatch News, 2020). In a Daily Nation newspaper publication on 25th January 2021, the Zambian Government launched and commenced the construction of the above project, which was expected to be ready in March, with the first silk export in July of the same year.

On June 5TH, 2021, Lusaka Times reported that the employment rate for local men and women at Mpika had doubled owing to the growth of the silk project in the district. This has aided other social interventions such as

refurbishing schools, building health posts, police posts, and fuel-filling stations, and serving the Mpika folks within the Muchinga Province.

In the 2020 annual project report of the Tropical Institute of Development Innovations in Uganda, over fifty (50) districts were reported to have been involved in mulberry and sericulture cultivation, namely Bulambuli, Mbarara, Nakasongola, Mubende, Zombo, Bukedea, among others. Furthermore, statistics by the International Sericulture Commission (2020) emphasize that Uganda produced 3.10 metric tons of silk in 2019, ranking 20th out of 22 silk-producing countries worldwide. This perhaps relates to an indication of sericulture growth in the country.

Ssemugenze et al. (2021) add that both rural and urban communities in Uganda have benefited in recent times from sericulture production either by direct or indirect employment gains, with key reference to silkworm seed production, mulberry production and cultivation, silkworm rearing, silk fabric making, silk cocoon reeling, printing, dyeing and silk products marketing.

Farmers in Uganda have been encouraged to enlarge their mulberry fields and rearing facilities due to assistance from the African Development Foundation to aid cocoon production and increase incomes.

Datt and Ravallion (1997) opined that for any economic development and poverty reduction strategy to yield the needed success, a substantial increase in agricultural activities must be a key player with its associated technological change. Therefore, the government of Rwanda has proposed to yoke the potential of sericulture as a new facet of agricultural innovation that is ready to propel employment growth and income generation. Therefore, in the country's Vision 2020 agenda, sericulture development has been prioritised and integrated, aiming to migrate Rwanda from a low-income destination into a knowledge-based economy (Wladimir and Habiyaremye, 2013).

Owing to this, Rwanda, since 2005, has put in enough effort to develop sericulture as a new branch of its agricultural activities and has received significant attention from the citizenry with high hopes of maximising export potential (Homidy and Papaskiri, 2017). The Government has incorporated a developmental agenda on Sericulture into its Economic Development and Poverty Reduction Strategy Programme. The smallholder Cash and Export Crop Development Project supports sericulture activities with key assistance from the International Fund for Agriculture and Development (IFAD). In a report issued by the International Fund for Agriculture and Development (2020), Rwanda's National Agricultural Export Development Board (NAEB) collaborated with a Korean Silk Manufacturing Company (HEWorks) to put up a silk processing factory in Kigali's Special Economic Zone.

This, as affirmed by Ogunlusi and Olaniyan (2021), has subsequently become a major export for the country but challenged by a lack of sufficient technological expertise, manufacturing factories in the silk production processes, cocoon growth requirements, steep topography and scattered human settlement.

Elsewhere in Zimbabwe, sericulture production was introduced in the latter stages of the 20th century and showed promising future growth reflections at the initial stages. According to the Technical Centre for Agricultural and Rural Cooperation (1994) in the Netherlands, Zimbabwe-rearing houses were traditionally constructed using handmade bricks and local thatch. The training was also provided in caring for and handling eggs, cocoons, and larvae during silkworm rearing. Further results later showed that a sizably trained staff could manage all stages of the silk processing up to selling silk locally. Still, they had suffered very challenging moments regarding its development and sustenance.

However, a report issued by the Food and Agriculture Organization of the United Nations (2001) indicated that the Government of Zimbabwe designed legislation, the Sericulture Act (Chapter 18:18), to regulate and control the production, breeding, rearing, reeling, twisting, marketing of silkworm seed, cocoons and raw silk. This was after the Government had realised the enormous benefits in three main folds: Mulberry trees as a good soil erosion control mechanism, silk production as a suitable venture for small-scale production and sericulture as a high employment and income generation opportunity, especially for rural folks.

After being introduced to sericulture, Egypt did well in the 20th century, especially in the 1980s. For example, McDougal (1985) testifies that Egypt, by the close of 1983, could produce five (5) tons of silkworm cocoons and had reached six (6) tons also by 1985. This resulted in enough stock of raw silk to weave over ninety-two thousand yards of silk fabrics.

Recently, Egypt has been crippled with challenges ranging from technology to climatic issues, which have affected the growth rate. Diab et al. (2009) submit that silk is the third known raw material after linen and wool. Local production is rated far below domestic consumption of silk, putting pressure on the Country's economy. They now produce a ton of silk cocoons out of the three hundred and fifty (350) tons they consume annually (Yahya, 2020). Through its Ministry of Finance, the Government has waived duties on importing silkworm eggs to aid silk production in the Country. This is expected to develop small and medium-scale projects to create more employment and income.

From the above literature, quite a number of African countries are still struggling or have just started the practice and are all making efforts to grow the venture knowing the economic relevance. This reflects the significantly less impact the sericulture industry has on all the economic trends of the continent.

HISTORICAL PERSPECTIVE OF SERICULTURE IN GHANA

Silkworm rearing started in 1992 on a pilot basis in the Eastern Region of Ghana, specifically Akuapim-Mampong. It extended subsequently to Yeji, Bogoso, Daboase, Prestea, Peki, Odumase-Krobo, Akyem Sekyere, Tamale and Koforidua. However, the country's climatic conditions have significantly impacted the growth of the mulberry tree and silkworm in diverse ways, posing extreme challenges for some regional practices (Siddiqui, 2000). Orhan and Ercisli (2010) add that although mulberries can be well adapted to different climatic and soil conditions, they still differ in numerous morphological features, productivity and quality of fruit. The unfavourable climatic conditions in Ghana since the beginning of the practice have resulted in low productivity in rearing areas, forcing small-scale farmers across the country to switch to alternative farming methods that are more resilient to weather uncertainties. This has subsequently affected the progress and growth of the venture in the country (Hifza, 2020).

That notwithstanding, the country is confronted with some peculiar practical problems, including a lack of high-yielding and drought-resistant mulberry varieties, a systematic egg supply programme and poor infrastructure facilities such as rearing houses and equipment (Jaishankai, 2009). Ampiah et al. (2014) affirm that interest in the venture dwindled in Ghana due to problems related to low-yielding mulberry varieties, poor silkworm eggs and functional rearing houses and equipment. Similar conditions were faced by silk farmers in the Kashmir state in India till 1988 due to monopoly by some actors in the industry being demonopolized by new government policies, which prompted the research for climate-resistant mulberry trees and restructuring of the sericulture subsector.

The challenges Ghana faced in the initial stages of silk production were problems confronting developed industries elsewhere, but they were resolved due to appropriate

steps. These suggest that similar measures could be implemented to revamp Ghana's almost-dying venture. Certain environmental (natural and manmade) conditions and government policies are key elements affecting the growth of sericulture production in Ghana.

THE CURRENT STATE OF SERICULTURE IN GHANA

Ghana has been working tirelessly to grow its sericulture industry. Even though it is fairly new, Ghana seeks to develop the venture just as other African countries with similar or socio-economic problems have used sericulture production to curtail them.

According to Ntaanu (2006), the introduction of the sericulture venture was spearheaded by a Ghanaian researcher trained in tropical at the Asian Institute for Rural Development, Karnataka State – India. Realizing the relevance of sericulture in alleviating poverty, the American Duo organized an exhibition on sericulture at the Ghana International Trade Fair Centre in Accra in 1992. The exhibition's extreme mileage resulted in the formation of the Sericulture Production and Development Association of Ghana in the same year. The group's major focus was to bring together huge assistance in developing and promoting sericulture in the country to create employment, generate income and enhance diversity in Ghana's agricultural sector. Due to its national interest, the Registrar of Companies documented it in May 1994 under the companies' code. Since then, the sericulture industry in Ghana has received a lot of help from the diaspora. Notably, it is the team of consultants to Ghana from the Food and Agriculture Organization (FAO) - United Nations in 1993, 1995, and 1997. Their mission was to investigate the sustainability of Sericulture in the country and to assist the Government and the Sericulture Association of Ghana in assessing grants from the Technical Co-operation Programme (TCP) at the FAO – UN.

Therefore, in April 2002, this materialized as FAO at the UN-approved US $384,000 for a project dubbed TCP/GHA 2802 (A) "Sericulture and Silk Processing Development". Again, approval was given for a periodic International Partnership Programme on Consultancy regarding cocoon production, processing, and silk processing. This aimed to support small-scale farmers in producing cocoons and raw silk by providing them with basic techniques and valuable tools for rearing silkworms and processing cocoons, resulting in employment and income opportunities.

The support yielded a turning point and a proven milestone in the history of the sericulture industry in Ghana because it rescued the industry's obvious collapse and gave it a push into sustenance. Also, a processing factory to manage cocoon and silk was established in the country under TCP, with training given to engineers and technicians from the Institute of Industrial Research of the Ghana Council for Scientific and Industrial Research and members of the Sericulture Association in the operation and maintenance of the machines. This was to encourage farmers on the availability of a market once they venture into cocoon production.

However, with all these efforts at the initial stages of sericulture perpetuation in Ghana, the venture has not grown enough to its expected heights, with key concerns regarding its decline. Climatic conditions remain a key factor affecting sericulture production in Ghana and the world (Siddiqui, 2000). This has subsequently affected numerous silk-rearing activities, initially doing well in Eastern, Western, Volta and Northern Ghana. Hifza (2020) affirms that climatic conditions in Ghana from the early stages of the practice have resulted in low productivity in areas noted for the rearing of silkworms and forced peasant farmers into alternative methods that could withstand the unstable weather conditions.

Currently, only mulberry sericulture is practised in Ghana (Obeng-Ofori, 2017) as the country continues to struggle with other pragmatic problems relating to the unavailability of drought-resistant mulberry variety, high-yielding mulberry variety, periodic egg supply programmes and poor infrastructure and lack of equipment to accelerate fieldwork. Ampiah et al. (2014) attest that farmers' interest in sericulture production declined in Ghana due to low-yielding mulberry varieties, poor silkworm eggs and functional rearing houses and equipment.

Unfortunately, as in other African countries, Ghana's dream of growing speedily enough may not be achieved if the situation remains the same. Therefore, there is an urgent pragmatic need to reorganize the country's developmental agenda of sericulture production.

POLICY DIRECTION ON SERICULTURE IN GHANA

Since the early 1990s, Ghana has been confronted with extreme poverty growth, indicating vulnerability and exclusion amongst some groups (especially in the North) are increasing. The presence of government is easily identified by the capability of the regime to protect and promote the well-being of its citizenry. Laws often passed by governments are meant to regulate the interactions of citizens, ensuring it thus improves their welfare. Furthermore, essential laws for good governance are defined as enshrining social protection and promoting citizens' material well-being. Especially in developing countries, this is very prevailing as a substantial share of the population lives in poverty and depends so much on government assistance. If aspirations are important for citizen welfare, exploring how government policy can influence them is essential for understanding its obligations to foster and protect that welfare (Kosec and Mo, 2017).

For instance, according to Naik (2017), the silk industry until 1988 had been plunged into a monopoly in Kashmir (a state in India), where farmers virtually had no benefit from the cocoon sale as per floor price fixed by the government. Then, however, a deep thought of having it revamped was considered. The government subsequently demonopolized the operation and directed that plant ownership be transferred to the farmers with the permission to sell surplus leaves and earn money. This aided and saved the industry from collapsing completely. Moreover, farmers now took much of mulberry trees, increasing plant demand. Silkworm seeds are free to farmers, and the government and private entrepreneurs purchase cocoons.

However, in Ghana, successive governments, donor agencies, and several other institutions have attempted to implement several alternative life support projects to diversify rural communities whose economies depend on illegal mining. According to some agrarian professionals, this seeks to promote and improve the livelihood of rural folks if schemes are skill-based (Hilson and Banchirigah, 2009).

The Government of Ghana 2008 launched a National Social Protection Strategy policy to empower communities through sustainable programmes to eradicate poverty and create employment opportunities. Saravanan (2016), in a report on Demand Analysis of Ghana, states that the government, through the Country Programming Framework (CPF) 2013-2016, sets out three (3) critical areas in achieving this, namely:

1. Food and nutrition security
2. Environment and sustainable natural resource management
3. Rural development and resilient livelihoods

Rural development and resilient livelihoods focus on creating decent employment opportunities and diversification in rural communities. The report added that training individuals in Sericulture and other skilled-

based areas would provide opportunities to improve rural poverty. In 2019, the JLIFAD report on Investing in Rural People submitted that the Medium-Term National Development Policy Framework (MTNDPF) 2018-2021 remains Ghana's basic policy for national development. It seeks to:

i. Generate opportunities for every Ghanaian
ii. Protect and secure resilience for the natural environment.
iii. Ensure a stable, united and safe country and
iv. Develop a prosperous society.

Strategically, sericulture revival in typical low- and middle-income economies could emanate from silk cottages that are principally borne out of government support for establishing minor to medium enterprises. This is especially needful in Africa and Ghana since the continent has less experience developing sericulture, producing inferior grades and a smaller quantity of raw silk for export.

On the other hand, building a comprehensive database regarding the venture in Ghana has equally affected the policy direction and resulted in a huge limitation in planning that has to do with monitoring the development of the venture. These strategies, by implication, will seek to develop the growth direction of sericulture in Ghana if such policies are carefully instituted and managed (Tzenou and Lea, 2006).

At the beginning of the 21st century, the Government of Ghana instituted a policy for the garment and textile industry in the country. The aim was to render huge support to the dying garment and textile industry in the country with the dream of meeting the demands under the African Growth Opportunity Act and creating equal employment and subsequent incomes for families. This focus dwelt on the wheels of indicators such as true political commitment, parliamentary and state proactiveness in terms of participation, policy-making rationalisation and roles implementation, Institutional capacity, distribution of power at all levels, roles of civil society and traditional authority about the poor, vulnerable and excluded and alignment of resource allocations with poverty reduction and growth (Ghana Poverty Reduction Strategy, 2003-2005).

ECONOMIC IMPACT OF SERICULTURE IN EMERGING ECONOMIES

The income of over twenty million families of farmers and employment opportunities of a million workers are born out of the sericulture industry in China (Zengzhi, 2006). In India, sericulture plays a very effective role in the appropriate and efficient use of natural resources, yielding socio-economic growth with livelihood, employment, and income generation (Malik et al., 2008). The industry has brought women empowerment, poverty alleviation, rural development and employment generation for the youth even though it exists as a cottage (Paramjit and Vibha, 2011). Dewangan (2017) adds that both the skilled and unskilled in the shades of women aged at home are all keenly occupied with this lucrative venture with extremely minimum risk. This reduces excessive migration and increases development in rural areas owing to growth security aligned with this practice. Dewangan et al. (2011) and Sitti (2017) affirm that excessive migration among regional/state boundaries is checked naturally. Rural folks engage in sericulture production, make enough for a living from their low investment venture, and raise the farming community's economic status.

In India, for instance, it is estimated that sixteen (16) people gain employment from every hectare of a mulberry farm, providing high revenues for all family members, irrespective of whether they are skilled or unskilled (Kasi, 2013). Naik (2017) emphasizes that sericulture in Kashmir employs about 30,000 families in the rearing of silkworms and 5,000 persons in the public sector on a part-time and regular basis, respectively, with another bulk of employment for over 10,000 weavers on full-

time. For so many years, this has directly contributed to the unemployment rate in the country, ensuring the curbing of other vices which may have been generated out of unemployment. In the latter of the 20th century, Inbanathan and Vijayalakshmi (1997) observed that economic development formed the major focus of many countries' governments, especially around Asia and parts of Europe. Therefore, in India, sericulture is now noted to aid the development of its citizenry, provide employment, generate high revenues, and impact the entire country's economy.

The industry is well-established in traditional countries like Japan, China, and Korea, yielding equally rapid economic progress in other developed and underdeveloped countries (Geetha & Indira, 2011).

TECHNOLOGICAL ADVANCEMENT IN SERICULTURE

Ma (2004) opines that raw silk consists of bundles of long, continuous silk threads used for weaving. Traditionally, the entire process begins with the cultivation of mulberry plants, the leaves harvested and used to feed the silkworm that later develops into self-spun cocoons. Ma (2004) said this was a common practice in Japan and China until the late 19th and early 20th centuries. The involvement of technology brought their production capacities regarding sericulture way apart, with Japan increasing drastically and becoming dominant in the global market.

Although considered a subsidiary on the occupational front, technological innovations have made its cultivation and operations highly intensive, making it hugely a revenue generation venture (Kasi, 2013). In a typical instance, Deshmukh (2009) submits that thousands of silkworms were killed for using the conventional sericulture process due to their cruel and tedious nature. However, technology through the Ahinsa peace silk innovation aided the process by using empty pierced cocoons to weave silk. This suggests that the overwhelming silkworm killed by the conventional process consequently led to the loss of revenue and other positive returns from the venture. If not corrected, losses would increase, plunging the venture into a gradual collapse.

Technological innovations are key, especially if prospects regarding the future of sericulture are to be considered. Hutkova (2017) states that Italy, though not a powerhouse of global silk, had very innovative technologies, which the Bengals in India adapted. Amidst their environment's new climatic and socio-economic context, the English East India Company (EEIC) operationalised these innovations with the right yield perspective. The Industry's profitability is directly aligned with the probability of high-quality mulberry leaves. Meanwhile, abiotic and biotic stresses affect mulberry cultivation and subsequent good yields. According to Khurana and Checker (2011), these technological innovations have brought genomics of mulberry that seeks to develop a stress-tolerant mulberry with desired characteristics meant to increase yield and profitability.

Kunimi (2007) also submits that Japan encountered several pest-disease issues that affected its yield in the early 20th century. However, getting to the latter, adopting insect pathogens into scientific research activities aided the development of several microbial insecticides, which have subsequently enhanced and continue to grow the venture in the region.

Environmental issues with soil fertility remain a severe concern in agriculture, fueled by high economic industrialization, atmospheric precipitation, and poor managerial activities of natural resources (Homidy and Papaskiri, 2017). These industrialized activities bring about the spread of heavy metals, creating serious resistance to decomposition. These eventually affect the healthy development of the mulberry plant, causing them to lose weight and value. Nikolova et al. (2017) opine that the technology of phytoremediation is increasingly aiding in reducing, in some cases

eradicating, the poor state of lands in industrial areas meant to cultivate mulberry. Furthermore, this innovation restores soils polluted with heavy metals and constant organic pollutants.

CHALLENGES OF COMMERCIAL SERICULTURE PRODUCTION

Sericulture production globally has witnessed appreciable growth even though it continues to struggle through some unforeseen challenges amid its gradual demand. These challenges have practically been borne out of the rate at which man-made activities, deforestation and industrialisation have grown over the past years and led to obvious climatic change. These effects are inevitable and widespread (Burghila et al., 2015).

It must, therefore, be noted that climatic issues are relevant at the local and national levels of policy structuring and a wake-up call at international levels for integrating policy within and between countries (Aldy and Robert, 2007).

These climatic events have brought about varied conditions as mulberry is grown under these conditions (ranging from temperate to tropical), which mostly reflect the difference in yielding characteristics that affect the development of sericulture. Siddiqui (2008) and Karst and Lechowics (2007) all attest that mulberry plants cultivated under such varied climatic conditions to feed the silkworms for three years showed a clear difference in length, internodes and plasticity in relation to environmental conditions. This affirms that worms that feed on these harvested leaves develop positively or otherwise in subsequent product yield.

Zah and Mărghitaş (2011) present another dimension to the mulberry situation, stating that scarcity of fresh mulberry leaves sometimes has also led to the use of artificial diets that are equally expensive and cannot be entirely employed as a substitute for feeding the worm (Munhoz et al., 2013).

Etebari and Matindoost (2004) report serious production declines due to the high ascorbic acid added to the silkworm feed. In addition, the study revealed an interruption of the larvae's normal feeding and growth rate. However, this has resulted in increased larvae mortality during moulting.

Culturally, Ghana has had to revolve around a particular style of livelihood practices that seem to have impacted our way of life socially and economically. McLeod (1981) opines that the behaviour of the natural environment, as interpreted by several ethnic groups in Ghana regarding our farming practices, has subsequently affected almost all aspects of social and economic lives.

Dyasi (1985) stressed that traditionally, the culture of Ghana had established a firm connection between farming practices and the environment. Between 1957 and 1964, the import industrialisation agenda affected the economic policy that could have paved the way for much focus on export industrialisation. However, by 1984, the typical colonial era (Gold Coast) agricultural policies were designed to favour export-based cash crops such as coffee, cocoa and rubber, neglecting food crop production. Moreover, the then government invested many resources in putting up factories and industries to cater for consumer goods that were previously imported (Seini and Nyanteng 2003). This suggested a prospective future in the sector but could never be grown as required.

With all these developments, much was expected to show in the growth agenda of diversity in the agrarian sector. Unlike before, the government now pays less attention to promoting such ventures and does not invest in their growth, as it did in the mid to third quarter of the 20th century. Unfortunately, virtually everyone who desired the agricultural sector wished for the same cash crop production or peasant food farming because that has a more proven market and revenue returns comparatively. Diversity was missing as the socio-cultural practices of the people seemed to have jeopardized their

efforts. Farmers are now comfortable growing what they are sure of and getting results known to them. Climatically, farmers were conversant with crops and their respective climatic seasons and, therefore, would concentrate on food and cash crop production rather than risking in an unknown production area with less or no success history in their cultural settings.

Again, successive governments have still not realized the need to create industries that serve as ready markets for individuals who would have gone into silkworm rearing and mulberry cultivation. Therefore, a few who can produce at such levels are still woefully remunerated as industries are not even available to patronize their produce. This socio-economic challenge has also affected Ghana's highly expected growth rate of sericulture.

These and many other challenges have wrestled and continue to mitigate against the commercial viability of many countries seeking to develop their sericulture production in parts of the world, particularly in Africa and Ghana.

PROSPECTS OF SERICULTURE IN GHANA

Ghana, as a country within the West African sub-region of the continent, expresses its growth on the wheels of many economic-oriented activities that require fewer investments but higher returns. However, more often than not, its management style does not enhance growth, causing its breakdown. When this happens, we cannot assess its relevance even though it may have succeeded in other parts of the globe. Sericulture production is one such venture that has still not been explored enough to ascertain its relevance in revenue generation and subsequent poverty eradication, as in other developed and semi-developed countries.

According to Ismayilova et al. (2017), for its irreplaceable uniqueness and characteristics, silk is used not only in our daily lives or the textile industry but also in the manufacture of other articles such as radio engineering, electrotechnology, insulation coil for electric and telephone wire, cinematography, aviation and aerospace, medical surgery, tyres of racing cars, artillery gunpowder and including surgical sutures. Moreover, it is one of the best textile materials for its hygienic, leniency, elegance and beauty features. Therefore, there is a steadily increasing demand for natural silk and cocoon, valuable raw materials in the global market. In many parts of the world, standards of living, modern economic growth, and the population's quality of life have been propelled by sericulture production.

Zengzhi (2006) affirms that over twenty million families of farmers and employment opportunities for one million workers are born out of the sericulture industry in China. Similarly, in India, the Industry has brought women empowerment, poverty alleviation, rural development and employment generation for the youth even though it exists as a cottage (Paramjit and Vibha, 2011). This is the situation in most sericulture practising regions, especially in Asia. By inference, Ghana stands a huge chance of achieving similar successes if we consider the practice of sericulture greatly, but unfortunately, it is reflected differently in the country. Therefore, special care should be given to developing sericulture as the major change in modern life. This has opened up new horizons in developing sericulture as in other sectors of the economy.

According to Yankson and Owusu (2007), poverty in Ghana is generally described as a rural phenomenon that cannot be denied even though urban poverty exists. Most households in rural settings rely on wood as fuel, have poor water supply, and live in congested rooms rather than fully accommodating apartments. All of these factors make inequality in terms of expenditure higher in rural settings than in urban areas (Adjasi and Osei, 2007).

Many attempts to solve the above concerns seem to have had insufficient effects. For instance, a Livelihood Empowerment Against Poverty (LEAP) programme was instituted in Ghana to help tackle extreme poverty. According to Fuseini et al. (2018), the programme improved food consumption, income levels, savings levels, access to healthcare and school attendance. Aside from this, young women from the northern parts of Ghana also engage in other menial jobs down south to seek a stop to their extreme poverty-driven lives (Awumbila and Ardayfio-Schandorf, 2008).

CONCLUSION

Undoubtedly, Ghana is undergoing several challenges in agrarian ventures but hopes to arrive at proven solutions. Eshun (2019) attests that this positive thought has been boosted by the government's quest to implement the industrial policy (IP) of one district, one factory (1D1F) in all its 254 districts, backed by a specific aim to create substantial employment opportunities especially, for the youth in rural and peri-urban communities and to enhance income levels, standard of living and reduce rural-urban migration. In Ghana, particularly, less attention is paid to sericulture production by the government in terms of policy direction and financial investment.

The sericulture industry in Ghana is comparatively younger but not without great potential for growing mulberry plants and rearing silkworms due to favourable environmental conditions. Also, labour availability could be another positive condition that could boost this growth. However, for the above to yield the expected relevance, pragmatic measures must be put in place by all stakeholders to offer solutions to the many challenges faced by the industry in Ghana. Ampiah et al. (2014) add that this can be used for poverty alleviation, women empowerment, forest and biodiversity conservation, employment creation and artisan development.

It should be noted that sericulture production as an alternative agrarian venture is a proven area that has, over the years, affected many deprived families and economies worldwide, especially on the Asian continent. Even though it is a lucrative and highly poverty-alleviation tool, it still requires less financial commitment, making it quite easy for individuals and families with less financial muscle to venture into production. According to the study, the extent of employment generation associated with this venture is equally overwhelming and has impacted many economies.

In Ghana, the situation is different as attempts by successive governments to develop the venture into a more vibrant state to impact the lives of the vulnerable and poor in society have failed and continue to struggle in its growth. Therefore, it is anticipated that the study would serve as an eye-opener to the Government of Ghana with key references to poverty alleviation and job creation strategies, ensuring a comprehensive development structure for sericulture production in the country.

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