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Impact of technical service centres as perceived by the sericulture beneficiary farmers in Karnataka state of India

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Abstract

Sericulture is a primary income source for over 125,000 farmers in Karnataka, and TSCs significantly contribute to their well-being. TSCs motivate farmers to adopt scientific technologies for mulberry cultivation and silkworm rearing, evidenced by increased production, productivity, and quality of mulberry and cocoons. Studying the impact of TSCs can reveal both direct and indirect changes perceived by farmers and their attitudes towards TSC activities. These findings can refine and reform extension methodologies, assessing the efficacy of TSC personnel by measuring knowledge and adoption rates among sericulture farmers. The study, conducted from 2018 to 2021 in Karnataka, India, utilized an ex-post-facto research design, deemed suitable as the phenomena under investigation had already occurred. The Ramanagara and Mandya districts were chosen due to their high concentration of Technical Service Centres (TSCs) in the Bangalore and Mysore divisions, respectively. Specifically, Mandya, Malavalli, and K.R. Pet taluks from Mandya district, and Ramanagara, Channapatna, and Kanakapura taluks from Ramanagara district, were purposively selected based on having the highest number of TSCs in each district. From these taluks, four TSCs per taluk were chosen, resulting in a total of 24 TSCs for the study. Ten sericulture farmers from each TSC were selected through random sampling, totalling 240 participants. Data collection was carried out using a well-structured interview schedule, and statistical tools such as frequency, percentage, mean, and standard deviation were employed for data analysis. The impact of TSCs on sericulture beneficiary farmers was measured in terms of direct and indirect changes as perceived by the farmers. The study found that, more than two fifth (40.84%) of the sericulture farmers belonged to medium direct changes succeeded by high (32.50%) and low direct changes categories (26.66%). More than half (51.25%) of the sericulture farmers had high income followed, due to intervention of TSCs. After interventions of TSC, more than half (52.92%) of the sericulture farmers belonged to medium sericulture mechanization category. Nearly half (47.08%) of the sericulture farmers belonged to medium indirect changes category succeeded by high (31.67%) and low medium indirect changes category (21.25%).

Keywords: Sericulture, direct changes, indirect changes, mechanization

Introduction

The sericulture extension system plays a crucial role in the sustainable development of sericulture, paralleling agricultural extension in its aim to improve the standard of living for farmers through enhanced learning. Agricultural extension aims to improve farmers' livelihoods by communicating research findings and practical information, often through organized group action. This system involves extension workers interacting with and teaching farmers about improved practices, supported by a steady flow of useful information and technical supervision.

Effective adoption of innovations hinges on efficient information dissemination, which is managed by extension agents trained in transmitting relevant sericulture information. These agents ensure farmers have timely access to advice and technologies. At the grassroots level, extension personnel identify sericulture problems and share them with scientists for solutions. Researchers and extension personnel collaborate to tailor technologies to local conditions and provide feedback, fostering communication links essential for adapting and advancing technological recommendations. (Sulaiman and Hall, 2004) [3]. India's 10th and 11th five-year plans highlighted agricultural extension as key to increasing agricultural growth by reducing yield gaps. Major changes since the late 1990s include decentralizing extension services, adopting pluralistic service provision modes, participatory approaches, and capacity training for farmers and service providers. Recent reforms aim to create a demand-driven, broad-based, and holistic agricultural extension system. Farmers need to adopt the latest technologies to maximize yield per unit area. Several programs, such as the Training and Visit System (T&V-1974) and Integrated Rural Development Programme (IRDP-1979), have aimed to

improve agricultural production and rural development. These initiatives emphasized transferring the right technology at the right time to the right farmers, underscoring the role of extension services in facilitating the flow of technologies from lab to land. (Birner and Davis, 2006) [4]. The sericulture extension system, involving central and state institutions like the Central Silk Board (CSB) and Central Sericulture Research and Training Institute (CSRTI), aims to modernize sericulture practices. However, the Karnataka State Department of Sericulture (KSDS) faces challenges, particularly in reaching large sections of farmers. Many farmers struggle to visit distant offices for information, highlighting a need for more accessible extension services. To address these gaps, the Government of Karnataka and the Department of Sericulture launched Technical Service Centres (TSCs) at the grassroots level. There are 246 TSCs in the state, each headed by a Sericulture Extension Officer and supported by two sericulture demonstrators. These centres disseminate technologies developed by research institutes, supply mulberry cuttings, monitor cultivation, and provide information on loans and subsidies. TSCs also conduct crop inspections, disinfection, group discussions, workshops, study tours, seminars, and training camps for farmers. Extension officers in seed areas inspect seed crops to certify disease-free conditions.

The success of the current demand-driven extension system depends on the effectiveness of its delivery mechanism, including adequate staffing, timely information, and input support. Sericulture is a primary income source for over 125,000 farmers in Karnataka, and TSCs significantly contribute to their well-being. TSCs motivate farmers to adopt scientific technologies for mulberry cultivation and silkworm rearing, evidenced by increased production, productivity, and quality of mulberry and cocoons. Studying the impact of TSCs can reveal both direct and indirect changes perceived by farmers and their attitudes towards TSC activities. These findings can refine and reform extension methodologies, assessing the efficacy of TSC personnel by measuring knowledge and adoption rates among sericulture farmers. The extension system has the potential to spread sericulture technologies to non-sericulture areas, enhancing agriculture's profitability. However, research on the sericulture extension system, specifically TSCs, remains limited, highlighting the need for further investigation.

Methodology

The study, conducted from 2018 to 2021 in Karnataka, India, utilized an ex-post-facto research design, deemed suitable as the phenomena under investigation had already occurred. The Ramanagara and Mandya districts were chosen due to their high concentration of Technical Service Centres (TSCs) in the Bangalore and Mysore divisions, respectively. Specifically, Mandya, Malavalli, and K.R. Pet taluks from Mandya district, and Ramanagara, Channapatna, and Kanakapura taluks from Ramanagara district, were purposively selected based on having the highest number of TSCs in each district.

From these taluks, four TSCs per taluk were chosen, resulting in a total of 24 TSCs for the study. Ten sericulture farmers from each TSC were selected through random sampling, totalling 240 participants. Data collection was carried out using a well-structured interview schedule, and statistical tools such as frequency, percentage, mean, and standard deviation were employed for data analysis. The impact of TSCs on sericulture beneficiary farmers was measured in terms of direct and indirect changes as perceived by the farmers. These impacts were operationally defined and assessed in the areas of crop production, economic, social, and political aspects before and after the intervention of the Technical Service Centres.

Direct changes

Direct changes are operationally defined as desirable or undesirable phenomena that are tangible and quantitative in nature, resulting from the functioning of Technical Service Centres (TSCs) among sericulture farmers. These changes are characterized by measurable outcomes in various aspects of sericulture, including cocoon and mulberry yield, farmers' income, employment generation, area under cultivation, quantity of silkworm rearing, asset creation, mechanization of sericulture processes, and reduction in the cost of cultivation. The following indicators were used to measure direct changes in the study.

Table 1: Direct changes

S. No.	Direct Changes
1.	Changes in Mulberry yield
2.	Changes in cocoon yield
3.	Changes in income
4.	Employment generation
5.	Changes in area of mulberry cultivation and quantity of DFLs rearing
6.	Asset creation
7.	Sericulture mechanization
8.	Reduction in cost of cultivation

A series of statements were formulated to assess the impact of Technical Service Centres (TSCs) on sericulture farmers in terms of direct changes. Eight items were used to gauge these changes, with scores assigned as 2 for "agree" and 1 for "disagree." The maximum and minimum possible scores for each respondent were 42 and 21, respectively. The individual total score was calculated by summing the scores of all items. Based on the mean and standard deviation, respondents were categorized into three groups as follows.

Table 2: Direct changes score

S. No.	Direct changes	Score
1.	Low direct changes	Less than (Mean - SD)
2.	Medium direct changes	Between (Mean ± SD)
3.	High direct changes	More than (Mean + SD)

Changes in mulberry yield

To assess the increase in mulberry and cocoon yields per acre and per 100 DFLs, respectively, resulting from the interventions of Technical Service Centres (TSCs), a schedule was developed in consultation with experts in sericulture and agricultural extension, as well as relevant literature. The changes in mulberry yield were operationally defined as the difference between the yields obtained per acre before and after the interventions of TSCs. This allowed for a comparative analysis of the impact of TSCs on mulberry yield. The sericulture beneficiaries were then classified into three groups based on the mean and standard deviation of the yield increases.

Table 3: Changes in mulberry yield

S. No.	Changes in mulberry yield	Score
1.	Low mulberry yield	Less than (Mean - SD)
2.	Medium mulberry yield	Between (Mean ± SD)
3.	High mulberry yield	More than (Mean + SD)

Changes in cocoon yield

To assess the changes in cocoon yield per 100 DFLs resulting from the interventions of Technical Service Centres (TSCs), a schedule was developed in consultation with experts in sericulture and agricultural extension, as well as relevant literature. The changes in cocoon yield were operationally defined as the difference between the yields obtained per 100 DFLs before and after TSC interventions. This enabled a comparative analysis of the impact of TSCs on cocoon yield.

The sericulture beneficiaries were then classified into three groups based on the mean and standard deviation of the yield changes.

Table 4: Cocoon yield

S. No.	Changes in Cocoon Yield	Score
1.	Low cocoon yield	Less than (Mean - SD)
2.	Moderate cocoon yield	Between (Mean ± SD)
3.	High cocoon yield	More than (Mean + SD)

Changes in Income

An attempt was made to assess the changes in income of sericulture beneficiaries resulting from the interventions of Technical Service Centres (TSCs). These changes were due to variations in the area, productivity, and production of mulberry and cocoons. A schedule was developed in consultation with experts in sericulture, agricultural extension, and relevant literature to determine the increase in income. The changes in income were operationally defined as the difference between the income generated from mulberry, cocoon, and other agricultural crops before and after TSC interventions. The income changes were categorized into three groups: low, medium, and high income, based on the mean and standard deviation.

Table 5: Income

S. No.	Changes in Income	Score
1	Low income	Less than (Mean - SD)
2	Medium income	Between (Mean ± SD)
3	High income	More than (Mean + SD)

Employment Generation

Employment generation was operationally defined as the additional man-days of employment generated for beneficiary families through sericulture activities as a result of Technical Service Centres (TSCs). The schedule consisted of a series of questions designed to measure the difference in employment creation before and after the interventions of TSCs.

Based on the total scores obtained by the beneficiaries for employment generation before and after TSC interventions, they were classified into three categories according to the mean and standard deviation, as follows:

Table 6: Employment generation

S. No.	Employment Creation	Score
1	Low employment creation	Less than (Mean - SD)
2	Medium employment creation	Between (Mean ± SD)
3	High asset employment creation	More than (Mean + SD)

Changes in Area of Mulberry Cultivation and Quantity of Silkworm Rearing

Changes in area of mulberry cultivation is defined as extent of area of mulberry cultivation is increased or reduced after becoming beneficiary of TSCs and measured in terms of acres.

Changes in quantity of silkworm rearing are defined as volume of DFLs has been increased or decreased before and after interventions of TSCs. Changes in area of mulberry cultivation and quantity of silkworm rearing were analyzed by using mean and standard deviation.

Asset creation

Asset creation is operationally defined as the quantity of farm implements and buildings possessed by sericulture beneficiaries before and after becoming beneficiaries of Technical Service Centres (TSCs). Assets such as rearing houses, mounting halls, drip irrigation systems, and sprayers are included. This will be measured using a checklist of farm implements and buildings, with scores of 1 and 2 assigned for the periods before and after TSC interventions, respectively.

The asset creation scores will be categorized into three groups: low, medium, and high asset creation, based on the mean and standard deviation.

Table 7: Asset creation

S. No.	Asset Creation	Score
1	Low asset creation	Less than (Mean - SD)
2	Medium asset creation	Between (Mean ± SD)
3	High asset creation	More than (Mean + SD)

Sericulture Mechanization

Sericulture mechanization is defined as number of mechanized technologies such as drip irrigation, portable mulberry pruner, mulberry cutter and shelf rearing system were adopted and utilised in mulberry cultivation and silkworm rearing before and after interventions of TSCs. Sericulture mechanization is categorised into three groups such as low, medium and high sericulture mechanization by using frequency, percentage mean, standard deviation.

Table 8: Sericulture mechanization

S. No.	Sericulture Mechanization	Score
1.	Low sericulture mechanization	Less than (Mean - SD)
2.	Medium sericulture mechanization	Between (Mean ± SD)
3.	High sericulture mechanization	More than (Mean + SD)

Reduction of Cost of Cultivation

Reduction of cost of cultivation is the assessment of decrease of cost incurred for the mulberry cultivation and silkworm rearing by the sericulture farmers before and after interventions of TSCs which is expressed in terms of rupees. It was analysed by using mean and standard deviation.

Indirect changes

Indirect changes are operationally defined as desirable or undesirable phenomena characterized by intangible and qualitative aspects, such as credit needs, self-confidence, decision-making ability, communication behavior, and cocoon marketing behavior. These changes result from the functioning of Technical Service Centres (TSCs) among sericulture farmers.

Indirect changes were measured using a three-point continuum: agree, undecided, and disagree, with scores of 3, 2, and 1, respectively. The maximum possible score was 66, and the minimum was 22. Based on the mean and standard deviation, the indirect changes experienced by sericulture beneficiaries were categorized into three groups: low, medium, and high indirect changes.

Table 9: Indirect changes

S. No	Indirect changes	Score
1	Low indirect changes	Less than (Mean - SD)
2	Medium indirect changes	Between (Mean ± SD)
3	High indirect changes	More than (Mean + SD)

Results and Discussion

Direct changes as perceived by the sericulture beneficiary farmers of TSCs

The study assessed direct changes among sericulture beneficiary farmers in terms of mulberry and cocoon yield, income, employment generation, asset creation, changes in mulberry cultivation area, quantity of silkworm rearing, sericulture mechanization, and reduction in cultivation costs resulting from the establishment of Technical Service Centres (TSCs) in Mandya and Ramanagara districts of Karnataka.

According to Table 1 and Figure 1, it is evident that a significant proportion of sericulture farmers experienced varying degrees of direct changes. Specifically, more than two-fifths (40.84%) of the farmers reported medium levels of direct changes, followed by high levels (32.50%) and low levels (26.66%).

Table 10: Distribution of sericulture farmers according to direct changes (n=240)

S. No.	Categorization	Frequency	Percentage
1.	Low direct changes (≤30.57)	64	26.66
2.	Medium direct changes (30.58- 35.08)	98	40.84
3.	High direct changes (≥35.09)	78	32.50
	Total	240	100.00
	Mean= 32.83	SD = 2.26	

The significant direct changes experienced by sericulture farmers, such as improvements in mulberry and cocoon yields, income generation, employment opportunities, asset creation, and mechanization, can be attributed to effective extension methodologies implemented by Technical Service Centre (TSC) extension functionaries. These methodologies include crop inspection, disinfection of rearing houses to prevent silkworm diseases, organizing group discussions, field days, workshops, and study tours, as well as conducting training programs. Furthermore, TSCs provided essential extension services such as supplying mulberry cuttings or saplings, monitoring mulberry cultivation and silkworm rearing practices, and disseminating information about loan facilities and subsidy schemes. These efforts have motivated sericulture farmers to prioritize sericulture as their primary occupation. Additionally, the availability of consultancy services from sericulture extension officers and demonstrators has enhanced farmers' knowledge and facilitated medium to high adoption rates of improved sericulture practices.

As a result of these comprehensive support measures, sericulture farmers have seen tangible improvements in mulberry and cocoon yields, income levels, employment opportunities, and the creation of assets within their farming operations.

Changes in mulberry yield

The findings from Table 2 and Figure 2 indicate that prior to the intervention of Technical Service Centres (TSCs), more than two-fifths (43.75%) of sericulture farmers had low mulberry yields, followed by medium yields (35.84%), with the remaining minority (20.41%) achieving high mulberry yields. After the introduction of TSCs, nearly half (47.92%) of the farmers achieved high mulberry yields, followed by medium yields (39.17%), and only 12.91% of farmers reported low mulberry yields. This signifies a significant increase in mulberry yields among sericulture farmers, with a notable 23.28% increase attributed to the introduction of TSCs.

The mean mulberry yield was observed to be 3096.94 Kg/Ac/Year before the TSC intervention, which increased to 3817.29 Kg/Ac/Year thereafter. This observed increase underscores the effectiveness of TSC interventions in enhancing mulberry yields.

Furthermore, the calculated Z value of 8.59**, significant at the 0.01 level of probability, indicates a substantial difference between mulberry yields before and after the TSC intervention. This statistical significance reinforces the impact of TSCs in improving mulberry yields among sericulture farmers.

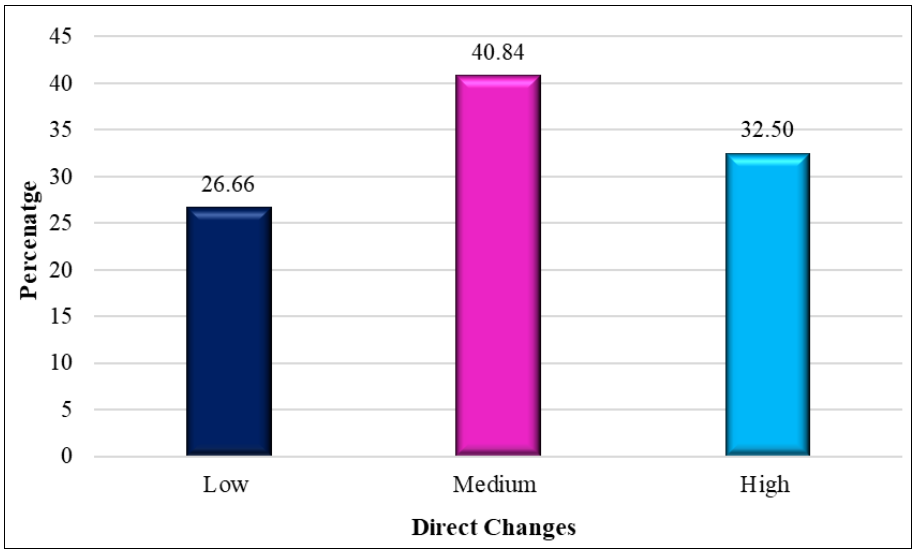

Fig 1: Distribution of sericulture beneficiary farmers according to direct changes

Table 2: Distribution of sericulture farmers according to changes in mulberry yield before and after the interventions of TSC (n=240)

S. No.	Category	Before TSC		After TSC		Percentage change	'Z' value
		F	%	F	%		
1.	Low mulberry yield	105	43.75	31	12.91	23.28	8.59**
2.	Medium mulberry yield	86	35.84	94	39.17		
3.	High mulberry yield	49	20.41	115	47.92		
Total		240	100.00	240	100.00		
Mean = 3096.94 Kg/Ac/Pruning, SD = 697.93				Mean = 3817.29 Kg/Ac/Pruning, SD =744.8647			

** Significant at 0.01 level of probability, F = Frequency, % = Percentage

Before the intervention of Technical Service Centres (TSCs), the distribution of mulberry yield among sericulture farmers, as shown in Table 3, indicated that more than two-fifths (42.08%) of farmers achieved yields between 2476-3051 Kgs, followed by 40.42% in the range of 1900-2475 Kgs, 16.25% in the range of 3052-3627 Kgs, and a minimal 1.25% in the range of 3628-4204 Kgs.

After the introduction of TSCs, the distribution shifted significantly, with more than two-fifths (43.75%) of farmers now achieving yields in the range of 3628-4204 Kgs. This was followed by 38.33% in the range of 3052-3627 Kgs, 13.33% in the range of 2476-3051 Kgs, and only 4.59% in the range of 1900-2475 Kgs. These findings illustrate a noticeable improvement in mulberry yield distribution among sericulture farmers after the implementation of TSC interventions, highlighting the positive impact of these initiatives on agricultural productivity.

Table 3: Item analysis of sericulture farmers according to mulberry yield during before and after TSC (n=240)

S. No.	Mulberry Yield (Kg/Acre/Pruning)	Before TSC		After TSC	
		F	%	F	%
1	1900-2475 Kg	97	40.42	11	4.59
2	2476-3051 Kg	101	42.08	32	13.33
3	3052-3627 Kg	39	16.25	92	38.33
4	3628-4204 Kg	3	1.25	105	43.75
	Total	240	100	240	100

F = Frequency, % = Percentage

The increase in mulberry yield observed after the intervention of Technical Service Centres (TSCs) can be attributed to several factors. Initially, sericulture farmers experienced low yields due to the use of low-yielding mulberry varieties such as Mysore local and M5, limited availability of disinfectants, and insufficient knowledge on pest and disease management.

With the introduction of TSC interventions, farmers anticipated an increase in mulberry yield by adopting key recommended technologies for mulberry cultivation. These included the adoption of high-yielding mulberry varieties (such as V1), application of Farm Yard Manure (FYM) at a rate of 20 tons per acre, optimal spacing (90 x 90 cm), and bottom pruning techniques, which are recognized as effective practices for enhancing yield.

Furthermore, TSCs played a crucial role by providing regular consultancy services to improve farmers' knowledge and facilitate the adoption of these recommended technologies.

They also subsidized the supply of superior quality V1 mulberry variety saplings, making them more accessible to farmers. Additionally, the active involvement of input dealers and fellow farmers in the village played an essential role in supporting and encouraging the adoption of these

practices, thereby contributing to the overall increase in mulberry yield at the local level. This results were in line with Meerat *et al.* (2018)

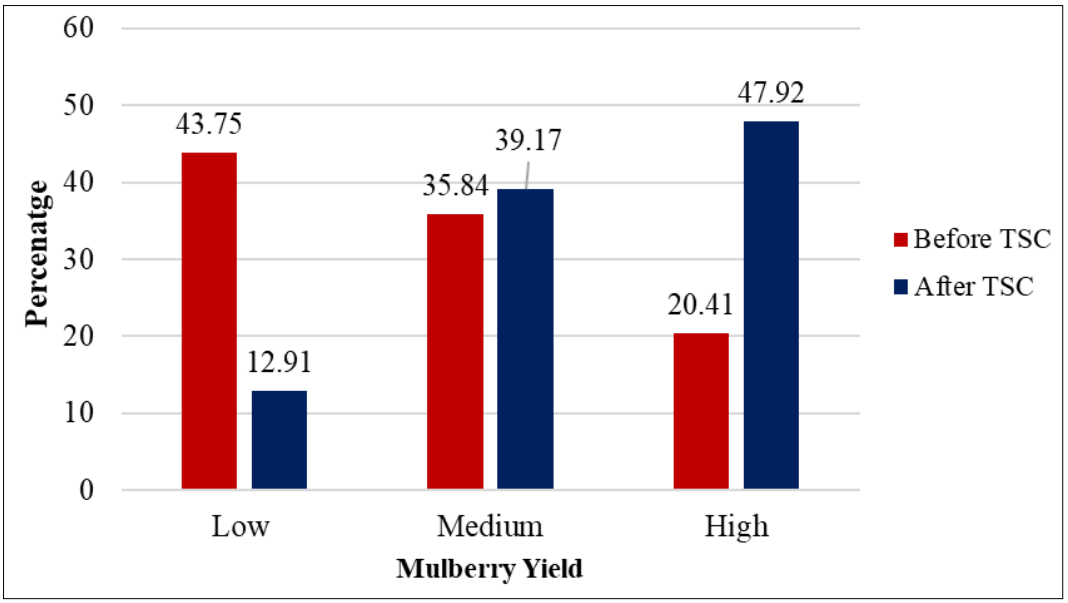

Fig 2: Distribution of sericulture beneficiary farmers according to changes in mulberry yield before and after the interventions of TSC

Changes in Cocoon Yield

The results furnished from Table 4 and Figure 1. Found that before the intervention of TSC, nearly two third (66.26%) of the sericulture farmers had low cocoon yield succeeded by medium cocoon yield (25.83%) and only meagre (7.91%) per cent of the them had high cocoon yield. After TSC intervention, nearly three fifth (57.08%) of the sericulture farmers had high cocoon yield followed by medium (30.84%) and low yields (12.08%). It also projected that 37.72 per cent cocoon yield is increased before and after intervention of TSC. The mean mulberry yield is about 55.40 and 76.30 Kg/100 DFL/Crop was experienced during before and after TSC respectively. Hence, there was improvement in cocoon yield due to interventions of TSCs. Table 4 depicted that calculated Z value (6.37**) was significant at 0.01 level of probability which indicated that there existed a significant difference between mulberry yield before and after interventions of TSC.

Table 4: Distribution of sericulture farmers according to changes in cocoon yield before and after the interventions of TSC (n=240)

S. No.	Category	Before TSC		After TSC		Percentage change	'Z' value
		F	%	F	%		
1.	Low	159	66.26	29	12.08	37.72	6.37**
2.	Medium	62	25.83	74	30.84		
3.	High	19	7.91	137	57.08		
Total		240	100.00	240	100.00		
Mean = 55.40		SD = 23.76		Mean = 76.30		SD = 29.20	

** Significant at 0.01 level of probability
F = Frequency, % = Percentage

Table 5. highlighted that before the interventions of TSC, more than half (52.91%) of the sericulture farmers belonged to the range between 35-47.50 kg of cocoon yield followed by 47.51-60.01 kgs (24.17%), 60.02-72.52 Kgs (14.16%) and 72.53-85.02 Kgs (8.75%). Whereas, more than half (50.41%) of the sericulture farmers belonged to the range between 60.02-72.52 kg of cocoon yield succeeded by 72.53-85.02 Kgs (22.92%), 47.51-60.01 Kgs (17.08%) and 35.00-47.50 Kgs (9.58%) were observed after the interventions of TSC.

This might be due to fact that sericulture farmers experienced low cocoon yield (55kg/100 DFL) due to poor chawki and II instar silkworms, lack of availability of disinfectants, lack of knowledge on silkworm disease management etc., In this context, sericulture farmers expected to increase cocoon yield with the interventions of TSC like shoot feeding system, rack rearing method, scientific rearing houses, are perceived as good meanwhile all the interventions were contributed to increase in yield and there was regular consultancy services to improve knowledge on silkworm rearing among sericulture farmers for adopting recommended technologies.

Table 5: Item analysis of sericulture farmers according to changes in cocoon yield before and after the interventions of TSC (n=240)

S. No.	Cocoon Yield (Kg/100 DFLs)	Before TSC		After TSC	
		F	%	F	%
1	35.00-47.50	127	52.91	23	9.58
2	47.51-60.01	58	24.17	41	17.08
3	60.02-72.52	34	14.16	121	50.41
4	72.53-85.02	21	8.75	55	22.92
	Total	240	100.00	240	100.00

F=Frequency, %=Percentage

The private grainage centres were involved in door delivery of good quality II instar silk worms. The input dealer and fellow farmers role was inevitable in cocoon yield at village level. The results were line with Reddy *et al.* (2019)

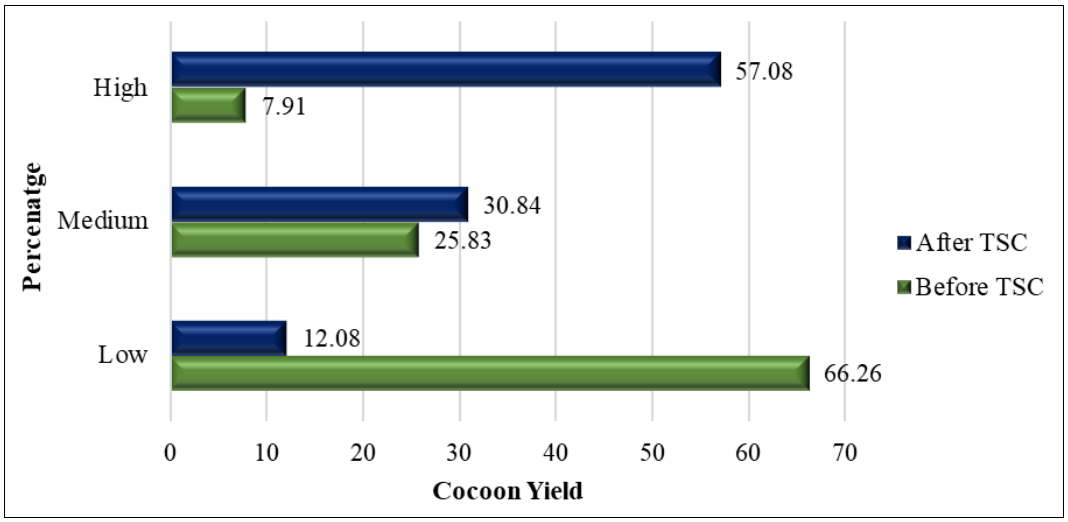

Fig 3: Distribution of sericulture beneficiary farmers according to changes in cocoon yield before and after the interventions of TSC

Changes in Income

A bird eye view of Table 6. and Figure. was highlighted that, more than half (52.08%) of the sericulture farmers had low income succeeded by medium income (35.00%) and only 12.92 per cent of them had high income experienced during before TSC introduction. After introduction of TSC, more than half (51.25%) of the sericulture farmers had high income followed by medium income (32.50%) and 16.25 per cent of them had low income.

Table 6 depicted that calculated Z value (10.77**) was significant at 0.01 level of probability which indicated that there existed a significant difference between changes in income before and after the interventions of TSC.

Table 6: Distribution of Sericulture farmers according to changes income before and after the interventions of TSC (n=240)

S. No	Category	Before TSC		After TSC		Percentage change	'Z' value
		F	%	F	%		
1	Low income	125	52.08	39	16.25	16.78	10.77**
2	Medium income	84	35.00	78	32.50		
3	High income	31	12.92	123	51.25		
Total		240	100.00	240	100.00		
Mean = Rs.1,11,653.3		SD =45,368.49		Mean = Rs.1,64,559.70		SD = 61,033.39	

** Significant at 0.01 level of probability

F=Frequency, %=Percentage

From the Table 7. projected that before the interventions of TSC, nearly three fifth (59.58%) of the sericulture farmers belonged to the income range of Rs.53,525- Rs.1,20,143.75 per annum followed by Rs.1,20,143.76- Rs.1,86,762.51 (27.92%), Rs. 1,86,762.52 - Rs.2,53,381.27 (8.33%) and only 4.17 per cent of sericulture farmers belonged income range of Rs.2,53,381.28 – Rs.3,20,000.03.Whereas, more than two fifth (41.66%) of the sericulture farmers belonged to the income range of Rs. 1,86,762.52 – Rs. 2,53,381.27 succeeded by Rs.1,20,143.76 – Rs.1,86,762.51 (31.25%), Rs.53,525 – Rs.1,20,143.75 (14.59%) and only few (12.50%) sericulture farmers belonged to the income range of Rs.2,53,381.28 – Rs.3,20,000.03. Hence, it could be concluded that there was an increased income due to interventions of TSCs.

Table 7: Item analysis of sericulture farmers according to changes income before and after interventions of TSC (n=240)

S. No.	Income/ Annum (Rs.)	Before TSC		After TSC	
		F	%	F	%
1	Rs. 53,525 – Rs. 1,20,143.75	143	59.58	35	14.59
2	Rs. 1,20,143.76 – Rs.1,86,762.51	67	27.92	75	31.25
3	Rs.1,86,762.52 – Rs.2,53,381.27	20	8.33	100	41.66
4	Rs. 2,53,381.28- Rs. 3,20,000.03	10	4.17	30	12.50
	Total	240	100.00	240	100.00

F=Frequency,%=Percentage

An income was main indicator to measure success, which realized from sericulture depends on cocoon price at govt. cocoon markets. The cocoon price of domestic market was depends on import duty fixed by ministry of commerce and

industry. Before TSC introduction, there was absence of consultancy services and farmers used to grow of Mysore local and M_5 mulberry varieties with low yield and low quality of mulberry leaves while same mulberry used for silkworm rearing which causes low yield (30-40 kg/100DFL) and poor quality of cocoon and the cocoon sold for less price (Rs.80-100/Kg) at Govt. Cocoon markets and low income among sericulture farmers. At the same time the govt. grainage centres were supplied poor chawki and II instar worms leads to more silkworm disease. After TSC introduction, they were involved in providing consultancy service like introduction of silkworm races (multivoltine and bivoltine races) and improved mulberry variety (V_1), market information through SMS service and support price (Rs. 10/Kg for multivoltine and Rs. 30/Kg for bivoltine) . The sericulture farmers could be seen income was observed within 25-30 days as compared to other subsidiary occupations. In addition to sericulture, farmers earned income other subsidiary occupations such as dairy, coconut plantation, mango orchard etc., The above reasons might be probable reasons for enhancement of income among sericulture farmers. The findings were matched with Mir *et al* (2018) [8].

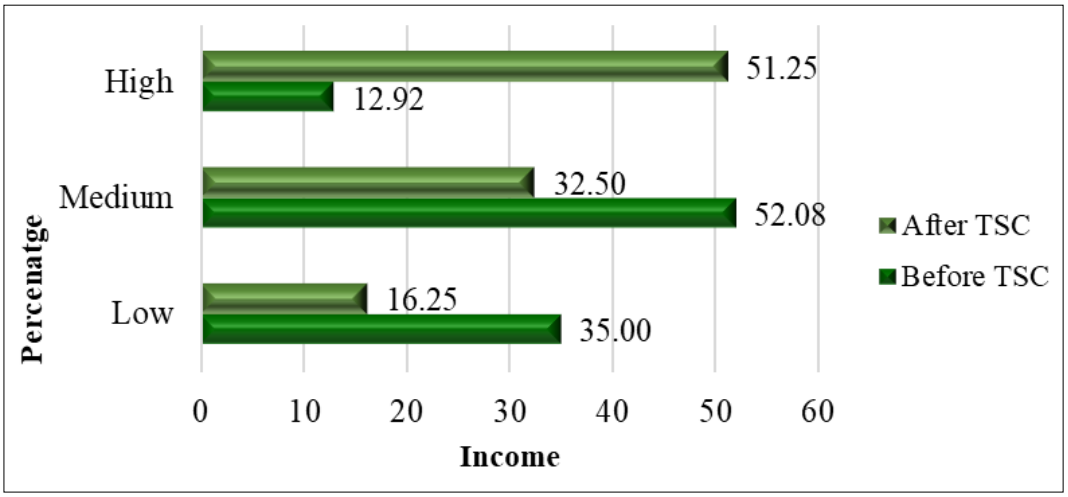

Fig 4: Distribution of sericulture beneficiary farmers according to changes in income before and after the interventions of TSC

Employment Generation

The results from Table 8 and Figure 5. was revealed that before TSC intervention, 45.00 per cent of the sericulture farmers had medium employment generation followed by low (31.92%) and high employment generation (17.08%). Whereas, nearly half (47.50%) of the sericulture farmers had high employment generation succeeded by medium (37.09%) and only 15.41 per cent of them had low employment generation, found after the intervention of TSC. It also observed that 29.76 per cent of employment generation during before and after interventions of TSC.

Table 8 revealed that calculated Z value (50.46**) was significant at 0.01 level of probability which indicated that there existed a significant difference between employment generation during before and after the interventions of TSC.

Table 8: Distribution of sericulture farmers in accordance with employment generation before and after interventions of TSC (n=240)

S. No.	Category	Employment Generation				Percentage change	'Z' value
		Before TSC		After TSC			
		F	%	F	%		
1	Low employment generation	91	37.92	37	15.41	29.76	50.46**
2	Medium employment generation	108	45.00	89	37.09		
3	High employment generation	41	17.08	114	47.50		
Total		240	100.00	240	100.00		
Mean = 235.15		SD =41.25		Mean =305.14		SD =39.25	

** Significant at 0.01 level of probability
F=Frequency, %=Percentage

The above trend was found due to fact that, sericulture farmers used to grow paddy, sugarcane, ragi and horse gram as major crops, provided employment during kharif season and few farmers during rabi season. Most of them were unemployed during lean season. Sericulture was the only subsidiary occupation which provides employment whole the year. However, farmers were motivated by TSC to take-up sericulture as main occupation, which could grow 10-12 silkworm rearing crops, provided average of 305 man days of employment. The results were follows the findings of Yadav (2013) [7].

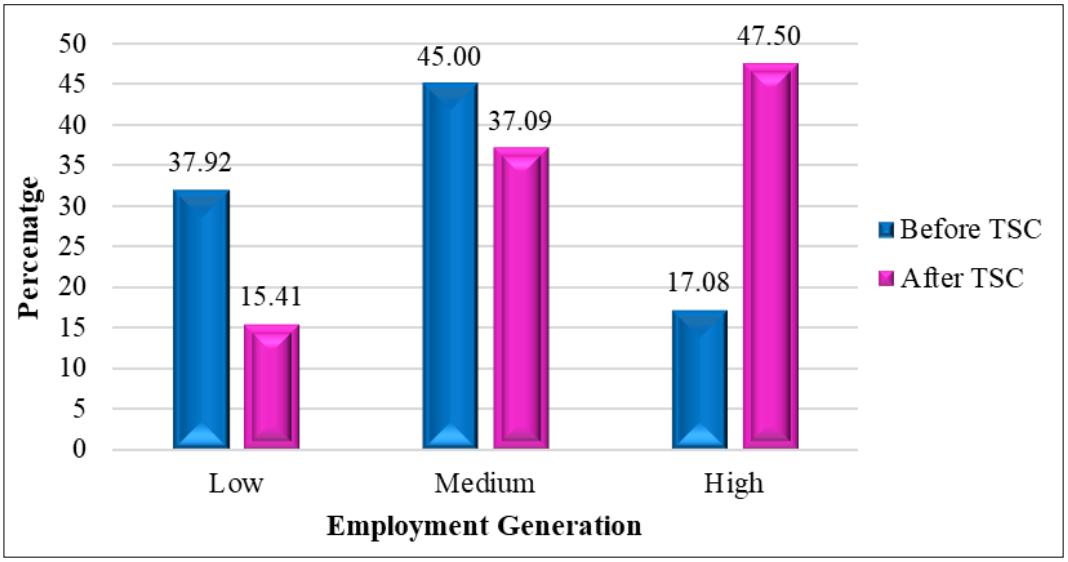

Fig 5: Distribution of sericulture farmers in accordance with employment generation before and after interventions of TSC

It was evident from the Table 9. was depicted that, nearly three fourth (72.50%) of the sericulture farmers had more than four members employment in sericulture from family succeeded by 3-4 members category (19.58%) and only 7.92 per cent of them employed 1-2 members in sericulture, above trend observed before the interventions of TSC. After the interventions of TSC, more than half (52.08%) of the sericulture farmers employed 1-2 members in sericulture from family followed by 3-4 members (25.00%) and remaining 22.92 per cent of them employed more than four members in sericulture.

Table 9 revealed that calculated Z value (1.24) was non-significant which indicated that there was no significant difference between number of family members employed in sericulture during before and after the interventions of TSC.

Table 9: Distribution of Sericulture farmers in according to number of family members employed in sericulture before and after the interventions of TSC (n=240)

S. No	Category	Before TSC		After TSC		Z Value
		F	%	F	%	
1	1-2 Members	19	7.92	125	52.08	1.24 NS
2	3-4 Members	47	19.58	60	25.00	
3	>4 Members	174	72.50	55	22.92	
Mean = 3.74		SD =1.02		Mean =1.95		SD =0.90

F= Frequency, %=Percentage, NS=Non Significant

Changes in area of mulberry cultivation and quantity of silkworm rearing

Table 10. found that, the mean scores for before and after the interventions of TSC differed significantly with 'Z' value (12.67 **) at 0.01 level of probability implied that there was an increase in area of mulberry cultivation among sericulture beneficiaries farmers due to the interventions of TSC. The mean area of mulberry cultivation before the interventions of TSC was 0.58 acre and after the interventions of TSC the mean area was 1.35 acres. It meant that TSC helped the beneficiaries to improve the area of mulberry cultivation.

It could be clear from Table 10. revealed that calculated Z value (5.14*) was significant at 0.05 level of probability which implied that there was significant difference between quantity of silkworm rearing before and after the interventions of TSC. Before the interventions of TSC, the mean quantity of silkworm rearing was 76.86 DFLs and after the interventions of TSC mean quantity of silkworm rearing was increased to 104.85 DFLs. It conveyed that TSC was helped to sericulture farmers in increasing in quantity of silkworm rearing. The probable reason might be due to that, TSCs involved in extension services include support price for cocoon, subsidy for mulberry seedlings, disinfectants, rearing house, mountages, drip irrigation etc., credit facilitated through PCARDB, high knowledge on sericulture technologies among sericulture farmers. In this context, sericulture farmers were influenced to increased area of mulberry cultivation and quantity of silkworm rearing to improve their income as well as family well being. The outcomes were consistent with Chowdary *et al.* (2017)

Table 10: Distribution of Sericulture farmers in according to area of mulberry cultivation and quantity of silkworm rearing before and after TSC (n=240)

S. No	Categories	Mean	SD	'Z' value
I	**Changes in area of mulberry cultivation (Ac.)**			
1	Area of mulberry before TSC	0.58	0.52	**12.67****
2	Area of mulberry after TSC	1.35	0.78	
II	**Changes in quantity of silk worm rearing (DFLs)**			
1	Quantity of Silk worm rearing before TSC	76.85	73.16	**5.14***
2	Quantity of Silk worm rearing after TSC	104.85	41.96	
** Significant at 0.01 level of probability * Significant at 0.05 level of probability				

Asset Creation

It was evident from the Table 11. and Figure 6. highlighted that before the interventions of TSC, nearly half (48.75%) of the sericulture farmers belonged to low asset creation category succeeded by high asset creation category (27.09%) and remaining nearly one fourth (24.16%) of them belonged to medium asset creation category. After TSC, nearly half (47.50%) of the sericulture farmers belonged to medium asset creation category followed by high asset creation category (36.67%) and only meager (15.86%) of them belonged to low asset creation category.

Table 4.38. revealed that calculated Z value (33.79**) was significant at 0.01 level of probability which indicated that there was a significant difference between asset creation before and after the interventions of TSC.

Table 11: Distribution of sericulture farmers according to asset creation before and after interventions of TSC (n=240)

S No.	Categorization	Before TSC		After TSC		Z value
		F	%	F	%	
1	Low asset creation	117	48.75	38	15.83	33.79**
2	Medium asset creation	58	24.16	114	47.50	
3	High asset creation	65	27.09	88	36.67	
	Mean= 0.275	SD = 0.48		Mean= 2.31		SD = 0.80

** Significant at 0.01 level of probability, F=Frequency, %=Percentage

It could be noticed from Table 12. that before the interventions of TSC, nearly one fourth (24.58%) and more than three fourth (75.41%) of the sericulture farmers had rearing house before and after the interventions of TSC respectively. Whereas, none of the sericulture farmers did not have mountage hall during before and after the interventions of TSC. In case of mountages, nearly one third (31.25%) and more than two third (68.75%) of them had mountages before and the interventions of after TSC respectively. Nearly one fifth (18.75%) and majority (81.25%) of the sericulture farmers had sprayers before and after the interventions of TSC, respectively.

Table 12: Item analysis of Sericulture farmers in according asset creation before and after interventions of TSC (n=240)

S. No	Particulars	Before TSC		After TSC	
		F	%	F	%
1	Rearing House	59	24.58	181	75.41
2	Mounting Hall	0	0.00	0	0.00
3	Mountages	75	31.25	165	68.75
4	Sprayers	45	18.75	195	81.25

F=Frequency, %=Percentage

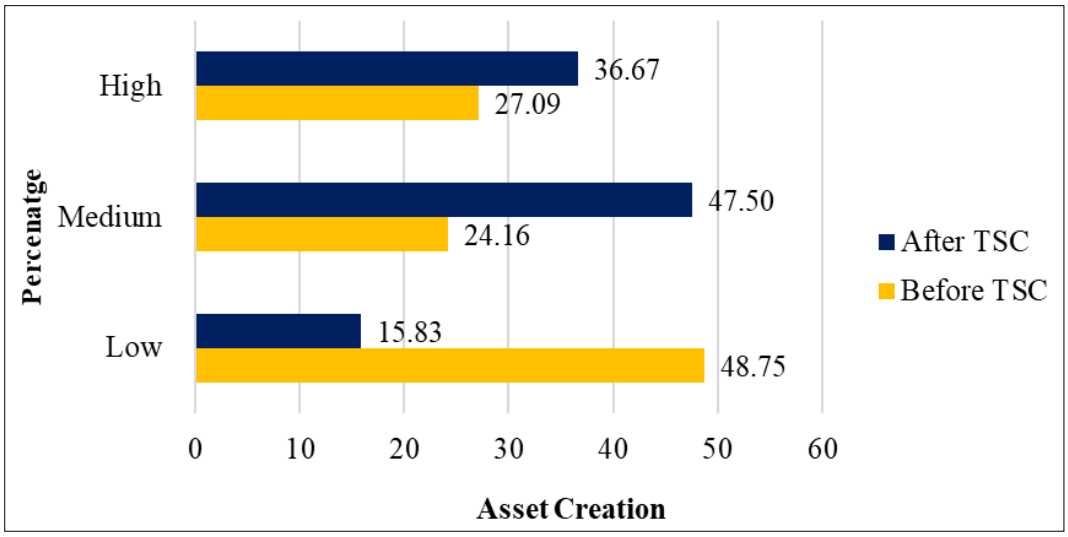

Fig 6: Distribution of sericulture beneficiary farmers according to asset creation before and after the interventions of TSC

Sericulture Mechanization

An evident from Table 13. and Figure 7 found that, before the interventions of TSC, most (89.58%) of the sericulture farmers belonged to low sericulture mechanization category followed by medium sericulture mechanization category (7.92%) and high sericulture mechanization category (2.50%). After the interventions of TSC, more than half (52.92%) of the sericulture farmers belonged to medium sericulture mechanization category followed by low sericulture mechanization category (37.50%) and only 9.58 per cent of them belonged to low sericulture mechanization category. The summary of above result was there was moderately improved in sericulture mechanization.

Table 13. depicted that calculated Z value (3.12*) was significant at 0.05 level of probability which indicated that there was a significant difference between sericulture mechanization before and after the interventions of TSC.

Table 13: Distribution of sericulture farmers in according sericulture mechanization before and after interventions of TSC (n=240)

S. No.	Categorization	Before TSC		After TSC		Z Value
		F	%	F	%	
1	Low sericulture mechanization	215	89.58	90	37.50	3.12*
2	Medium sericulture mechanization	19	7.92	127	52.92	
3	High sericulture mechanization	6	2.50	23	9.58	
	Mean= 0.01	SD = 0.12		Mean= 2.04		SD = 0.96

F=Frequency, %=Percentage

Sericulture was the labour intensive activity. Most of the labours, especially most of the women labours worked in garments for their livelihood, which caused the labour shortage was the severe problem for silkworm rearing. TSC introduced mechanization in mulberry cultivation and silkworm rearing such as drip irrigation, mulberry portable pruner, plastic meshes for harvesting, and mulberry cutter for feeding and shelf or beds system which were cost effective in nature. However, farmers adopted few mechanized technologies like shelf/rack rearing, tractor ploughing in mulberry garden and plastic meshes for silkworm harvest, as most of the sericulture farmers were small and marginal farmers who could not afford the cost technologies and lack of knowledge about technologies such as mulberry portable pruner, mulberry cutter during feeding and tractor ploughing in mulberry garden. The above probable reasons might be cause for above results. This findings were harmonized with Geetha *et al.* (2020) [96].

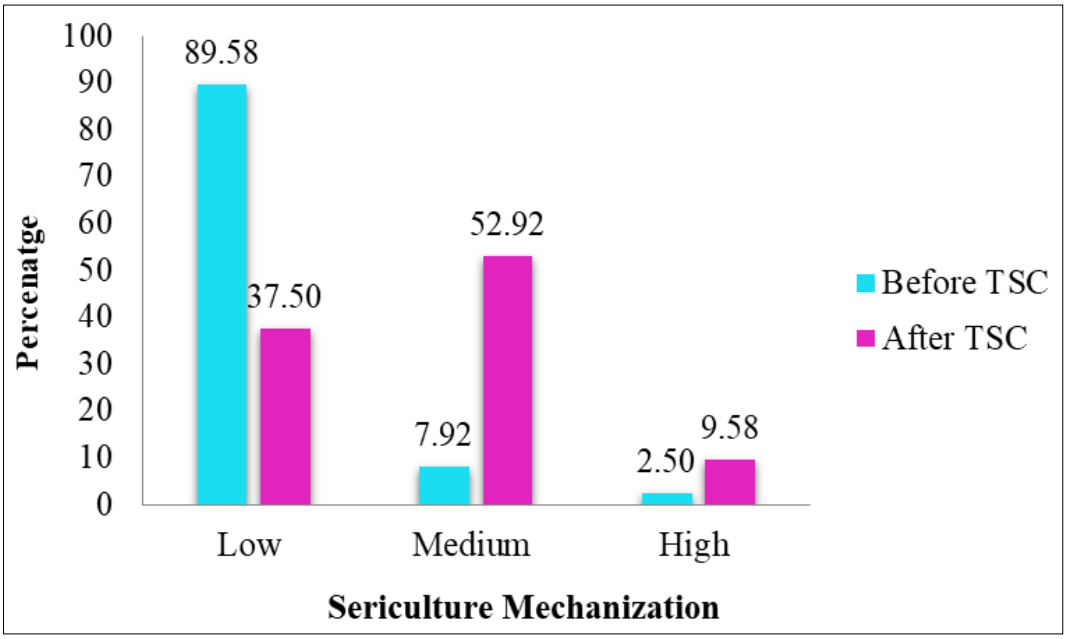

Fig 7: Distribution of sericulture beneficiary farmers according to sericulture mechanization during before and after interventions of TSC

It could be noticed from Table 14 projected that, before interventions of TSC, none of the sericulture farmers had mechanized technologies such as drip irrigation, mulberry portable pruner, tractor ploughing, mulberry cutter for feeding, shelfs/rack rearing and air conditioner. About 10.41 per cent and 6.25 per cent of sericulture farmers had plastic meshes for harvest and thermometer respectively. After TSC, Cent (100.00%) of the sericulture farmers had shelfs/rack rearing followed by plastic meshes for harvest (89.58%), tractor ploughing (38.30%) and thermo meter (22.08%).

Table 14: Item analysis of sericulture farmers in according sericulture mechanization during before and after interventions of TSC (n=240)

S. No	Particulars	Before TSC		After TSC	
		F	%	F	%
1	Drip irrigation	0	0.00	12	5.00
2	Mulberry portable pruner	0	0.00	0	0.00
3	Tractor ploughing	0	0.00	92	38.30
4	Plastic Meshes for harvest	25	10.41	215	89.58
5	Mulberry cutter for feeding	0	0.00	0	0.00
6	Shelfs/Rack rearing	0	0.00	240	100.00
7	Thermo meter	0	0.00	53	22.08
8	Air conditioner	0	0.00	0	0.00

F=Frequency, %=Percentage

Reduction of cost of cultivation

It could be clear from Table 15. that the calculated Z value (3.09*) was significant at 0.05 level of probability which implied that there was significant difference between cost incurred for mulberry cultivation before and after interventions of TSC. Before interventions of TSC, the mean cost incurred was Rs. 9732.97/ crop/acre and after interventions of TSC, mean cost was reduced to Rs. 9074.76/ crop/acre. It conveyed that TSC interventions resulted in cost reduction of Rs. 658.97 among sericulture farmers in mulberry cultivation.

It also evident from Table 15 found that calculated Z value (4.93 **) was significant at 0.01 level of probability which comprehended that there was significant difference between cost incurred in silkworm rearing before and after interventions of TSC. Before interventions of TSC, the mean cost incurred was Rs. 9,508.217 / crop/100 DFLs and after interventions of TSC, mean cost was reduced to Rs. 8,849.525/ crop/100 DFL. It conveyed that TSC interventions helped in cost reduction of Rs. 658.69 among sericulture farmers in silkworm rearing. It also depicted that totally about Rs.1, 317.66 was reduction in cost cultivation per crop in mulberry cultivation and silkworm rearing.

Table 15: Distribution of sericulture farmers in accordance with reduction of cost of cultivation of mulberry cultivation and silkworm rearing before and after interventions of TSC (n=240)

S. No.	Categories	Mean	SD	'Z' value
I	**Reduction in cost of mulberry cultivation (Rs./crop/Acre)**			
1	Cost of mulberry cultivation before interventions of TSC	9732.97	2400.38	**3.09***
2	Cost of mulberry cultivation after interventions of TSC	9074.76	2252.26	
II	**Reduction in cost of silk worm rearing (Rs/100 DFL)**			
1	Cost of silk worm rearing before interventions of TSC	9508.217	1441.789	**4.93****
2	Cost of silk worm rearing after interventions of TSC	8849.525	1481.505	
** Significant at 0.01 level of probability * Significant at 0.05 level of probability				

The probable reason might be due to fact that, low cost reduction observed in mulberry cultivation and silkworm rearing was due to the introduction of shelf/rack rearing by TSC which requires one-two family members were reared 75-100 DFLs by involved in activities such as mulberry pruning, feeding and maintained of micro climate and helps to save labour wage among sericulture farmers. In addition to this, less usage of insecticides and fungicides for pest and disease management in mulberry cultivation and silkworm rearing Besides this, the continuous extension efforts made by TSC by conducting demonstrations, training programmes, study tours and exposure visits leads to gained knowledge and motivated by sericulture farmers towards adoption of cost reduction technologies might be reason for cost reduction. This result are in line with Hadimani *et al.* (2017) [5]

Indirect changes as perceived by the sericulture beneficiary farmers of TSCs.

Bird eye view of Table 16 and Figure 8. showed that, nearly half (47.08%) of the sericulture farmers were belonged to medium indirect changes category succeeded by high (31.67%) and low medium indirect changes category (21.25%).

Table 16: Distribution of sericulture farmers according to their indirect changes (n=240)

S. No.	Categorization	Frequency	Percentage
1	Low indirect changes(≤44.60)	51	21.25
2	Medium indirect changes (44.61-51.63)	113	47.08
3	High indirect changes (≥51.64)	76	31.67
	Total	240	100
	Mean= 48.12	SD = 3.52	

Results furnished from the Table 17. revealed that, more than three fourth (77.50%) of the sericulture farmers were agreed that there was improved in cocoon marketing behaviour followed increase knowledge on sericulture programmes (74.16%), increased women empowerment (73.33%), increased knowledge on mulberry and silkworm rearing practices and TSCs services (70.83%), increased quality of cocoon production (68.33%), improved in information seeking behaviour (67.91%), improved communication behaviour (66.25%), change in skill in mulberry cultivation silk worm rearing (64.16%), reduced in usage of plant protection chemicals (63.75%), increased the entrepreneurial behaviour among sericulture farmers (63. 33%), change in attitude (62.08%), increased credit needs (60.41%), autonomy in decision making (60.41%), increase Cosmopoliteness (53.75%) , improving standard of living (52.09%), increased education standards of children (48.75%), development of self-respect (42.50%) and change in social life (40.83%), decrease in migration of farmers (32.50%) attracted rural youth towards sericulture (32.50%) and purchase of household (23.33%) and purchase of land (21.25%).

A bird eye view from Table 17. projected that one third of the sericulture farmers were perceived as undecided for 'Development of self-respect (33.33%)' followed by increase cosmopoliteness (31.25%), increased education standards of children (30.41%), increased the entrepreneurial behaviour among sericulture farmers (29.16%), improving standard of living (28.33%), reduced in usage of plant protection chemicals (25.83%), autonomy in decision making (24.16%), change in skill in mulberry cultivation silk worm rearing (24.16%), increased credit needs (23.33%), change in social life (22.91%), increased knowledge on mulberry and silkworm rearing practices and TSCs services (21.25%), increased quality of cocoon production (20.00%), purchase of land (18.75%), improved communication behaviour (18.33%), purchase of household (18.34%), improved in information seeking behaviour

(17.50%), change in attitude (17.08%), improved in Cocoon marketing behaviour (15.42%), increased women empowerment (14.58%), increase knowledge on sericulture (14.16%), decrease in migration of farmers (12.91%) and attracted rural youth towards sericulture (10.83%).

Table 17. also showed that, three fifth (60.00 %) of the sericulture farmers perceived as disagree for purchase of land succeeded by purchase of household (58.33%), attracted rural youth towards sericulture (56.67%), decrease in migration of farmers (54.59%), change in social life (36.26%), increased quality of cocoon production (31.67%), development of self-respect (23.75%), increased education standards of children (20.84%), change in attitude (20.84%), improving standard of living (19.58%), increased credit needs (16.26%), improved communication behaviour (15.42%), autonomy in decision making (15.42%), increase cosmopolitans (15.00%), improved in information seeking behaviour (14.59%), increased women empowerment (12.09 %), increase knowledge on sericulture programmes (11.67%), change in skill in mulberry cultivation silk worm rearing (11.67%), reduced in usage of plant protection chemicals (10.42%), increased knowledge on mulberry and silkworm rearing practices and TSCs services (7.92%), increased the entrepreneurial behaviour among sericulture farmers (7.5%) and improved in cocoon marketing behaviour (7.08%).

Table 17: Item analysis of indirect changes resulting from TSCs among sericulture beneficiary farmers (n=240)

S. No.	Statements	Agree		Undecided		Disagree	
		F	%	F	%	F	%
1	Increased credit needs	145	60.41	56	23.33	39	16.26
2	Improved in cocoon marketing behaviour	186	77.50	37	15.42	17	7.08
3	Change in social life	98	40.83	55	22.91	87	36.26
4	Decrease in migration of farmers	78	32.50	31	12.91	131	54.59
5	Increased education standards of children	117	48.75	73	30.41	50	20.84
6	Improved communication behaviour	159	66.25	44	18.33	37	15.42
7	Development of self respect	102	42.50	81	33.75	57	23.75
8	Autonomy in decision making	145	60.41	58	24.16	37	15.42
9	Increased women empowerment	176	73.33	35	14.58	29	12.09
10	Increased knowledge on mulberry and silkworm rearing practices and TSCs services	170	70.83	51	21.25	19	7.92
11	Reduced in usage of plant protection chemicals	153	63.75	62	25.83	25	10.42
12	Improved in information seeking behaviour	163	67.91	42	17.50	35	14.59
13	Increased the entrepreneurial behaviour among sericulture farmers	152	63.33	70	29.16	18	7.51
14	Increase knowledge on sericulture programmes	178	74.16	34	14.16	28	11.67
15	Change in attitude	149	62.08	41	17.08	50	20.84
16	Change in skill in mulberry cultivation silk worm rearing	154	64.16	58	24.16	28	11.67
17	Attracted rural youth towards sericulture	78	32.50	26	10.83	136	56.67
18	Increased quality of cocoon production	164	68.33	48	20.00	76	31.67
19	Purchase of household	56	23.33	44	18.34	140	58.33
20	Increase cosmopoliteness	129	53.75	75	31.25	36	15.00
21	Purchase of land	51	21.25	45	18.75	144	60.00
22	Improving standard of living	125	52.09	68	28.33	47	19.58

F=Frequency,%=Percentage

The above trend brings to noticed that the sericulture farmers were experienced medium to high indirect changes due to TSC interventions. The reasons might be due to, cocoon marketing behaviour of sericulture farmers was improved due to trainings on grading of cocoons, packing material used, precautions during transportation, and exposure visits to successful e-trading cocoon markets at Ramanagara and Shidlagatta for the farmers were organized by TSC extension functionaries and the credit needs of sericulture farmers was increased because of adoption of TSC interventions in sericulture like establishment of V_1 variety garden, rearing house construction, purchase of mountages, establishment of shelf rearing system etc, which incurred huge cost. The sericulture farmers acquired high knowledge on mulberry cultivation and silkworm rearing practices due to farmers had more than 20 years of experience in sericulture and TSC extension functionaries' extension activities like crop demonstration, consultancy services, and study tours to progressive farmer's field in Kolar district, distribution of folders and pamphlets in Kannada language among farmers. Increased quality of cocoon production, due to adoption of scientific practices in mulberry cultivation under the guidance of TSCs such as, supply of quality of 2nd instars silkworms, shoot feeding thrice a day, bed disinfectants application schedule, maintenance of temperature (23-28^{o} C) and relative humidity (50-60^{o}C) and uzi fly pest management, might be the probable reasons.

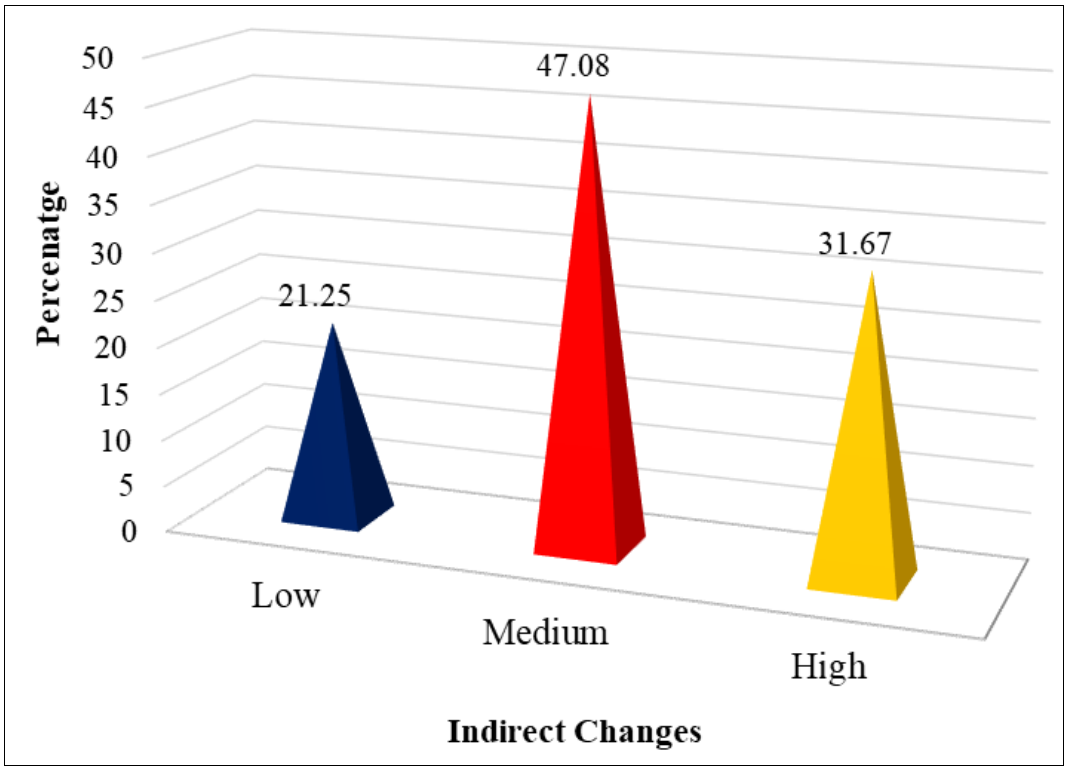

Fig 7: Distribution of sericulture beneficiary farmers according to indirect changes

Conclusion

The study concluded that the majority of sericulture farmers experienced moderate direct and indirect changes due to the implementation of Technical Service Centres (TSCs). These centres have led to increased mulberry and cocoon yields, higher incomes, and greater employment generation. Consequently, TSC officials have been effective in implementing programs and disseminating scientific sericulture technologies through appropriate mass media channels among all sericulture farmers.

To further enhance these benefits, the Department of Sericulture should establish TSCs in non-traditional sericulture areas to attract new farmers, thereby improving their socio-economic status. The study also revealed that most sericulture farmers fell into the medium mechanization category, followed by the low mechanization category, after the establishment of TSCs. Therefore, it is recommended that the Central Silk Board, the Central Sericulture Research and Training Institute in Mysore, and the Karnataka State Sericulture Research and Development Institute develop smallholder-friendly equipment for mulberry cultivation and silkworm rearing. Such innovations would help address labour shortages and further support the growth of the sericulture sector.

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