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The Impact of SHG Participation and Microfinance on Women's Empowerment: A Comprehensive Study from Rohilkhand

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Self-Help Groups (SHGs) have emerged as vital tools in promoting women's empowerment, particularly in rural settings. This study investigates the impact of SHG participation and microfinance on women's empowerment in the Rohilkhand region, a socio-economically diverse area in Northern India. Using a mixed-methods approach, the research analyzes the relationship between SHG membership and multiple empowerment dimensions—economic, social, political, and personal. Furthermore, it explores the role of microfinance in enhancing economic independence and decision-making abilities among women in SHGs. The study utilizes both quantitative data from a survey of 150 respondents and qualitative insights derived from in-depth interviews. Descriptive and inferential statistical analyses, including regression and clustering, are employed to identify key factors influencing empowerment outcomes. The findings highlight significant associations between education level, membership duration, and economic independence, revealing that SHG participation substantially fosters empowerment, particularly when complemented by microfinance services. This research provides evidence that supports the development of tailored policy interventions and targeted support programs to enhance the effectiveness of SHGs and microfinance in empowering rural women. The study's findings offer valuable insights for policymakers, NGOs, and other stakeholders involved in designing and implementing women's empowerment initiatives in similar socio-economic contexts.

Keywords: Economic Independence, Microfinance, Self-help group, Social Barriers, Women Empowerment.

1. Introduction

Self-Help Groups (SHGs) have become powerful vehicles for social and economic change, particularly in empowering rural women across developing nations. In India, SHGs are often associated with microfinance programs that provide small loans to women, thereby fostering entrepreneurship, enhancing economic independence, and promoting social and political participation. SHGs typically consist of 10-20 members who pool their savings and access credit from formal financial institutions. Through these groups, members gain financial autonomy and access to resources, knowledge, and networks that are otherwise unavailable to them.

The significance of microfinance in enhancing economic and social status among rural women cannot be overstated. Microfinance empowers women by providing access to capital for initiating small-scale enterprises, facilitating income generation, and improving their bargaining power within the household and community. Numerous studies (Yunus, 1999; Armendáriz & Morduch, 2010) have demonstrated the positive impact of microfinance on women's economic independence, decision-making abilities, and overall empowerment. However, the combined effect of SHG participation and microfinance on women's empowerment remains underexplored, particularly within specific regional contexts such as Rohilkhand.

The Rohilkhand region, located in Northern India, presents a unique socio-economic landscape characterized by a predominantly rural population, high levels of poverty, and limited access to formal financial services. The region's socio-cultural norms often restrict women's mobility, educational attainment, and access to economic opportunities, making it an ideal setting to examine the impact of SHGs and microfinance on women's empowerment.

Despite the growing body of literature on SHGs and microfinance, there remains a significant gap in understanding their combined impact on women's empowerment in specific regional contexts, such as Rohilkhand. While many studies have focused on the economic outcomes of SHG participation or microfinance alone, few have explored how these two factors interact to influence various empowerment dimensions, including economic, social, political, and personal. This study addresses this gap by examining the impact of SHG participation and microfinance on women's empowerment in the Rohilkhand region.

This research study aims to achieve the following objectives:

1. To analyze the impact of SHG participation on various empowerment dimensions (economic, social, political, and personal).
2. To investigate the role of microfinance in enhancing women's economic independence and decision-making abilities.
3. To explore the demographic and socio-economic factors that influence the extent of empowerment among women in the Rohilkhand region.

The research seeks to answer the following key questions:

1. What is the impact of SHG participation on women's empowerment in the Rohilkhand region?
2. How does microfinance contribute to economic independence among women in SHGs?
3. What are the demographic and socio-economic factors that significantly influence the empowerment outcomes?

This study is significant for several reasons. First, it provides a comprehensive analysis of the

interplay between SHG participation and microfinance in promoting women's empowerment in a specific regional context. Second, it contributes to the existing literature by providing empirical evidence on the combined impact of these two factors, thereby filling a critical gap in the research. Finally, the findings offer valuable insights for policymakers, non-governmental organizations (NGOs), and other stakeholders involved in designing and implementing women's empowerment programs. The study's recommendations can help optimize the impact of SHGs and microfinance initiatives, ensuring that they are more effective in achieving their intended outcomes.

2. Literature Review

2.1 Conceptual Framework of Women's Empowerment

Women's empowerment is a multifaceted concept encompassing various dimensions such as economic, social, political, and personal empowerment. According to Kabeer (1999), empowerment is defined as the process by which those who have been denied the ability to make strategic life choices acquire such an ability. Malhotra et al. (2002) further elaborate that empowerment includes increasing women's access to material resources, knowledge, and the ability to make decisions that affect their lives.

The economic dimension of empowerment involves access to financial resources, control over income, and participation in economic decision-making. The social dimension relates to women's participation in social networks, access to social capital, and improvement in social status. Political empowerment is characterized by the ability to participate in political processes and decision-making structures. Personal empowerment is reflected in self-confidence, self-efficacy, and the ability to assert one's rights.

2.2 SHGs and Women's Empowerment

Self-Help Groups (SHGs) have been instrumental in fostering women's empowerment across various regions. The literature highlights the role of SHGs in enhancing women's access to financial resources, promoting savings, and providing opportunities for income-generating activities. Swain and Wallentin (2009) demonstrate that SHGs positively impact women's economic, social, and political empowerment by improving their financial independence, decision-making power, and social status.

Case studies from different regions, such as Nair (2005) and Holvoet (2005), further support the positive impact of SHGs on women's empowerment. Nair (2005) discusses the experiences of SHG members in Kerala, emphasizing the role of collective action in increasing women's self-confidence and participation in community activities. Holvoet (2005) provides evidence from South Asia, illustrating how SHGs help women overcome social and cultural barriers, thereby promoting their overall development.

2.3 Microfinance and Economic Independence

Microfinance has emerged as a powerful tool for promoting economic empowerment, particularly among women. Yunus (1999) and Armendáriz and Morduch (2010) argue that microfinance provides access to credit for women who are traditionally excluded from formal financial systems, enabling them to start small businesses, generate income, and improve their economic status. The Grameen Bank model, pioneered by Yunus, has been widely adopted and replicated across the globe, with numerous studies affirming its positive impact on women's economic independence.

Banerjee et al. (2015) provide empirical evidence on the effectiveness of microfinance in

reducing poverty and enhancing economic independence. Their study, based on randomized controlled trials in India, shows that access to microfinance leads to increased household income, asset accumulation, and investment in education and health. Similarly, Morduch (1999) highlights the role of microfinance in promoting economic security and resilience among women in developing countries.

2.4 Gaps in the Existing Literature

While the existing literature offers substantial insights into the impact of SHGs and microfinance on women's empowerment, several gaps remain. Firstly, there is limited research on the combined impact of SHG participation and microfinance on women's empowerment, particularly in specific regional contexts like Rohilkhand. Most studies have focused on either SHGs or microfinance in isolation, neglecting the potential synergies between these two approaches.

Secondly, there is a need for more empirical studies examining the socio-demographic factors affecting empowerment outcomes. While some studies have explored the influence of factors such as education level, age, and marital status (Pitt et al., 2006; Swain & Wallentin, 2009), there is limited understanding of how these factors interact with SHG participation and microfinance to shape empowerment outcomes. This study aims to fill these gaps by providing a comprehensive analysis of the combined impact of SHGs and microfinance on women's empowerment in the Rohilkhand region.

2.5 Role of Demographic and Socio-Economic Factors in Empowerment

Empowerment is not a one-size-fits-all process; it is influenced by various demographic and socio-economic factors. Studies have shown that education level is a significant predictor of empowerment outcomes. Higher levels of education are associated with increased economic independence, decision-making abilities, and social awareness (Kabeer, 2001; Malhotra & Schuler, 2005). Additionally, age and marital status are crucial determinants of empowerment. Younger women, particularly those who are unmarried, tend to experience higher levels of personal and social empowerment, while older women may have more economic and political empowerment (Pitt et al., 2006).

Socio-economic factors, such as household income, occupation, and access to resources, also play a critical role in shaping empowerment outcomes. Women from higher-income households or those engaged in formal employment are more likely to experience economic empowerment (Swain & Wallentin, 2009). This study aims to explore these factors further by examining their influence on the empowerment outcomes of SHG members in Rohilkhand.

2.6 Interplay between SHG Participation and Microfinance in Women’s Empowerment

The interplay between SHG participation and microfinance is a critical area that has received limited attention in the existing literature. While both SHGs and microfinance independently contribute to women's empowerment, their combined effect may be greater than the sum of their individual impacts. SHGs provide a platform for collective action, social support, and knowledge sharing, which can enhance the effectiveness of microfinance programs. Conversely, access to microfinance can strengthen SHG activities by providing the necessary financial resources for income-generating activities, entrepreneurship, and community development.

Several studies suggest that the combination of SHG participation and microfinance can lead to improved empowerment outcomes. For instance, Swain and Wallentin (2009) argue that women who participate in both SHGs and microfinance programs experience higher levels of

economic independence, social status, and political participation compared to those who participate in only one of these interventions. However, these findings are based on limited regional studies, and there is a need for more comprehensive research to understand the full extent of the combined impact of SHGs and microfinance on women's empowerment.

2.7 Case Studies from Different Regions: Lessons for Rohilkhand

Research from different regions provides valuable insights that can be applied to the Rohilkhand context. For example, Holvoet (2005) demonstrates that in South Asia, SHGs have helped women overcome social and cultural barriers, increasing their participation in community decision-making processes. In another study, Nair (2005) highlights the role of SHGs in Kerala in promoting women's self-confidence and leadership abilities. These case studies underscore the importance of local contexts and highlight the need for region-specific studies to understand the unique challenges and opportunities faced by women in different socio-economic settings.

2.8 Inferences

The literature reviewed highlights the significant impact of SHGs and microfinance on women's empowerment, particularly in enhancing economic independence, decision-making abilities, and social awareness. However, it also reveals several gaps, including a lack of comprehensive research on the combined impact of SHGs and microfinance, particularly in specific regional contexts like Rohilkhand. This study aims to fill these gaps by providing a detailed analysis of the interplay between SHG participation and microfinance, as well as the demographic and socio-economic factors influencing empowerment outcomes.

3. Results

3.1 Demographic Overview

The demographic characteristics of participants in Self-Help Group (SHG) microfinance programs play a significant role in shaping the outcomes of such interventions. Understanding these characteristics is essential for identifying patterns of participation and the impact of SHG programs on various groups. This section provides a detailed analysis of the age, community, religion, education level, and occupation distribution of SHG members. The analysis also explores how these demographic factors interact with the economic and social benefits observed in the program.

3.1.1 Age Group Distribution

The age distribution of the SHG participants reveals a fairly even spread across different age groups, with a noticeable skew towards older participants. The breakdown is as follows:

Table 1: Age Group Distribution of SHG Participants

Age Group	Count	Percentage
26-35	17	17%
36-45	22	22%
46-55	13	13%
56-65	24	24%
66 and above	24	24%

Table 1 displays the distribution of SHG participants across five age groups, with the largest representation in the 56-65 and 66+ age categories, which account for 48% of the participants. This indicates that SHG programs are particularly appealing to older individuals, many of whom may seek financial stability in their later years.

It can be seen that 48% of the participants fall within the age groups of 56-65 and 66 and above. This suggests that SHG programs are attracting older participants, many of whom

may be nearing or in their post-retirement years. This is a significant finding, as older individuals, especially women, often face limited employment opportunities and financial dependency, which makes SHG microfinance programs particularly beneficial for this demographic.

The 36-45 age group, which represents 22% of the participants, is the next largest group. This demographic is typically at a stage of life where they are likely to have significant family responsibilities and require financial resources for their households. Younger participants, those between the ages of 26-35, make up a smaller percentage (17%), indicating that the program may have less appeal to or outreach towards younger individuals. However, the younger members may represent a group with higher entrepreneurial potential due to their ability to take risks and invest in long-term ventures.

The high participation of older individuals suggests that SHG programs are perceived as secure and reliable sources of financial assistance. For older participants, especially those above 56 years, the focus may be on financial security and supplementary income rather than starting new businesses or expanding existing ones. On the other hand, the presence of middle-aged participants (36-45) indicates that the program is also catering to individuals who are in their prime earning years but may still face challenges accessing formal financial services.

3.1.2 Community Distribution

The distribution of participants across different communities highlights the inclusive nature of the SHG microfinance program. The participants belong to various socio-economic backgrounds, with a strong representation from historically disadvantaged groups:

Table 2: Community Distribution of SHG Participants

Community	Count	Percentage
Backward Communities	46	46%
Most Backward Communities	21	21%
Scheduled Caste	20	20%
Forward Communities	9	9%
Scheduled Tribes	4	4%

Table 2 outlines the community backgrounds of SHG participants. A significant portion (46%) belongs to Backward Communities, while 21% and 20% come from Most Backward Communities and Scheduled Caste groups, respectively. These statistics highlight the SHG program's effectiveness in reaching marginalized communities.

Nearly half of the participants (46%) belong to Backward Communities (BC), while 21% are from Most Backward Communities (MBC), and 20% belong to the Scheduled Caste (SC) category. This indicates that the SHG program is effectively reaching marginalized groups that traditionally have limited access to financial services. The small representation of Scheduled Tribes (4%) and Forward Communities (9%) suggests that the program is less focused on these groups, perhaps due to their relatively better access to resources or alternative financial systems.

The high participation of Backward and Most Backward Communities demonstrates that SHG programs are playing a critical role in providing financial inclusion to socially and economically disadvantaged sections of society. These communities often face structural barriers to accessing formal financial institutions, making microfinance an essential tool for economic mobility. The focus on these communities aligns with broader national policies aimed at reducing income inequality and promoting inclusive growth.

3.1.3 Religion Distribution

The participants' religious affiliations reflect the religious diversity within India, though the vast majority are Hindus:

Table 3: Religion Distribution of SHG Participants

Religion	Count	Percentage
Hindu	80	80%
Muslim	9	9%
Sikh	10	10%
Christian	1	1%

Table 3 presents the religious affiliations of SHG participants. The majority (80%) identify as Hindu, followed by smaller groups of Sikh, Muslim, and Christian participants, reflecting the religious diversity of the program's reach.

The overwhelming majority of participants (80%) identify as Hindu, which is consistent with the religious demographics of many regions in India. The program also includes significant minority representation, with 10% of participants identifying as Sikh and 9% as Muslim. Only 1% of participants are Christian.

The relatively high proportion of Hindus participating in the program is reflective of India's overall population distribution. However, the inclusion of Muslim and Sikh participants indicates that the SHG microfinance model transcends religious boundaries, offering opportunities for financial empowerment across diverse faith groups. The inclusion of religious minorities, especially those with traditionally lower socio-economic status, reflects the inclusive approach of the SHG program.

3.1.4 Education Level Distribution

The education levels of SHG participants show a diverse range of educational attainment, with a significant number of participants having completed higher secondary education or more:

Table 4: Education Level Distribution of SHG Participants

Education Level	Count	Percentage
Illiterate	15	15%
Primary	12	12%
Higher Secondary School	41	41%
Graduates	32	32%

As shown in Table 4, participants with higher secondary education make up the largest proportion (41%), followed by those with a graduate degree (32%). A smaller percentage of participants (15%) are illiterate, indicating that the SHG program reaches individuals with varying educational backgrounds.

The relatively high percentage of participants who have completed higher secondary education or hold a graduate degree suggests that the SHG program is attracting individuals with the educational background necessary for making informed financial decisions. At the same time, the presence of illiterate participants (15%) highlights the program's ability to reach and support those who may be excluded from formal financial services due to educational barriers. This mix of education levels underscores the need for tailored interventions to support both highly educated individuals and those with limited literacy skills.

3.1.5 Occupation Distribution

The occupational distribution of SHG participants reflects a wide range of economic activities, with a notable emphasis on self-employment:

Table 5: Occupation Distribution of SHG Participants

Occupation	Count	Percentage
Self Employed	32	32%
Home Maker	16	16%
Private Employee	12	12%
Government Employee	11	11%
Others	17	17%
Tailor	8	8%

As shown in Table 5, the most common occupation among participants is self-employment (32%), followed by homemakers (16%) and those in the "Others" category (17%). The "Others" category may include various informal sector occupations. The data indicates that a wide range of individuals from different employment backgrounds are benefiting from the SHG program.

The dominance of self-employed individuals suggests that the SHG microfinance program is particularly effective in fostering entrepreneurial activities and supporting small businesses. Participants who are homemakers, government employees, and those in informal occupations also benefit from the program, though likely in different ways. For homemakers, SHG membership may provide an opportunity to gain financial independence, while for government and private employees, SHG participation may serve as a supplemental source of income or financial support for personal endeavors.

3.2 Descriptive Statistics

Descriptive statistics provide a foundational understanding of the data by summarizing key variables related to income, economic independence, and social awareness of SHG participants before and after their involvement in the program. These statistics offer insights into the overall impact of SHG participation on financial stability and socio-economic empowerment. In this section, we will explore changes in income, economic independence, and social awareness, offering a broad view of the outcomes experienced by participants.

3.2.1 Income Before and After SHG Participation

One of the key indicators of the success of SHG microfinance programs is the increase in participants' income. By comparing income levels before and after participation, we can assess the extent of financial improvement. For the purpose of this analysis, income is categorized into five ranges:

- 1: Less than ₹5000
- 2: ₹5001 - ₹10,000
- 3: ₹10,001 - ₹15,000
- 4: ₹15,001 - ₹30,000
- 5: Above ₹30,000

The descriptive statistics for income before and after SHG participation are as follows:

Table 6: Income Distribution Before and After SHG Participation

Statistic	Income Before SHG	Current Income
Mean	2.76	3.18
Median	2	3
Mode	1	4
Standard Deviation	1.62	1.44

Table 6 shows that the mean income category increased from 2.76 to 3.18. This implies that the average participant shifted from the ₹5001-₹10,000 income bracket (mean = 2.76) to the ₹10,001-₹15,000 bracket (mean = 3.18) after SHG participation. This suggests a significant improvement in income for the participants.

- Mean: The increase in mean income reflects the overall positive economic impact of SHG participation. The mean shifted upward, demonstrating that participants, on average, have moved into higher income categories.
- Median: The median income increased from 2 (₹5001-₹10,000) to 3 (₹10,001-₹15,000), meaning that at least half of the participants experienced income increases moving them into higher income brackets.
- Mode: The mode, or most frequent income category, changed dramatically from 1 (Less than ₹5000) before SHG participation to 4 (₹15,001-₹30,000) after. This indicates that a significant portion of participants now report much higher income, with a notable shift away from the lowest income group.
- Standard Deviation: A decrease in the standard deviation from 1.62 to 1.44 suggests that income levels among participants became more homogeneous after SHG participation. The variation in income is slightly reduced, possibly indicating that the SHG program helped stabilize income disparities among participants.

The increase in mean and median income levels, combined with the change in the mode, suggests that SHG programs are contributing to income growth and the upward economic mobility of participants. The fact that many participants have moved from lower to higher income brackets points to the success of microfinance in improving financial conditions for the economically vulnerable. Additionally, the reduced variation in income (lower standard deviation) may indicate that the SHG program is leveling the playing field, helping more participants achieve financial stability.

3.2.2 Economic Independence

Economic independence is another critical outcome of SHG microfinance programs. For this analysis, economic independence is measured on a scale of 1 to 5, with higher values indicating greater independence. The descriptive statistics for economic independence are presented below:

Table 7: Economic Independence of SHG Participants

Statistic	Value
Mean	3.13
Median	3
Mode	4
Standard Deviation	1.37

Table 7 summarizes the economic independence scores of SHG participants, measured on a scale of 1 to 5. The average score of 3.13 reflects moderate economic independence, with many participants experiencing a high degree of financial control.

- Mean: The average economic independence score of 3.13 suggests that participants, on average, experience a moderate level of independence. This means they have a fair degree of control over their financial decisions and may be able to manage their financial needs without external assistance.
- Median: A median score of 3 indicates that at least half of the participants report a moderate to high level of economic independence.
- Mode: The most frequent score of 4 indicates that a significant number of participants report high levels of economic independence, suggesting that the program has helped many individuals achieve substantial financial autonomy.
- Standard Deviation: The standard deviation of 1.37 points to some variation in the levels of economic independence among participants, indicating that while many have

achieved high levels of independence, others may still be in the process of gaining full economic self-sufficiency.

The findings suggest that SHG programs have been successful in fostering economic independence among participants, with a significant number reporting high levels of control over their financial lives. The variation in scores, however, indicates that not all participants experience the same degree of financial autonomy, which may be influenced by factors such as education, occupation, or community background. Nevertheless, the overall improvement in economic independence highlights the empowering potential of SHG programs.

3.2.3 Social Awareness

Social awareness is a critical component of empowerment, reflecting participants' understanding of their rights, roles in society, and participation in community life. Changes in social awareness as a result of SHG participation are summarized as follows:

Table 8: Changes in Social Awareness Among SHG Participants

Change in Social Awareness	Count	Percentage
Increased significantly	33	33%
Increased	38	38%
No change	19	19%
Decreased	7	7%
Decreased significantly	3	3%

Table 8 captures the reported changes in social awareness among SHG participants. A significant majority (71%) reported an increase in social awareness, with 33% experiencing a significant increase, indicating the program's impact on enhancing participants' understanding of social issues.

- Increased social awareness: A total of 71% of participants reported an increase in social awareness, with 33% experiencing a significant increase. This indicates that the SHG program has had a positive impact on the majority of participants in terms of enhancing their understanding of social issues and their role in the community.
- No change: About 19% of participants reported no change in their social awareness. This suggests that while the program has had a positive impact on many, some participants may not have experienced a noticeable shift in their social perspectives.
- Decreased awareness: A small percentage (10%) of participants reported a decrease or significant decrease in social awareness. While this is a minority, it points to potential gaps in the program's ability to consistently foster social consciousness among all participants.

The increase in social awareness among a majority of participants suggests that the SHG program is not only a financial tool but also a mechanism for social empowerment. The program appears to foster an enhanced understanding of social roles, responsibilities, and rights, which is crucial for holistic development. However, the presence of participants reporting no change or a decrease in social awareness underscores the need for a more targeted focus on social education and community engagement activities within SHG.

3.3 Inferential Statistics

To understand the relationships between SHG membership, demographic factors, and empowerment outcomes, several inferential statistical analyses were conducted.

3.3.1 Chi-square Tests:

1. Income Association:

Table 9: Income Association

Statistic	Value
Chi-Square Statistic	10.24
p-value	0.85
Degrees of Freedom	16

Table 9 shows the results of the chi-square test conducted to examine the association between income levels before and after joining SHGs. With a chi-square statistic of 10.24 and a p-value of 0.85 (greater than 0.05), the results indicate no significant association between income levels before and after SHG membership.

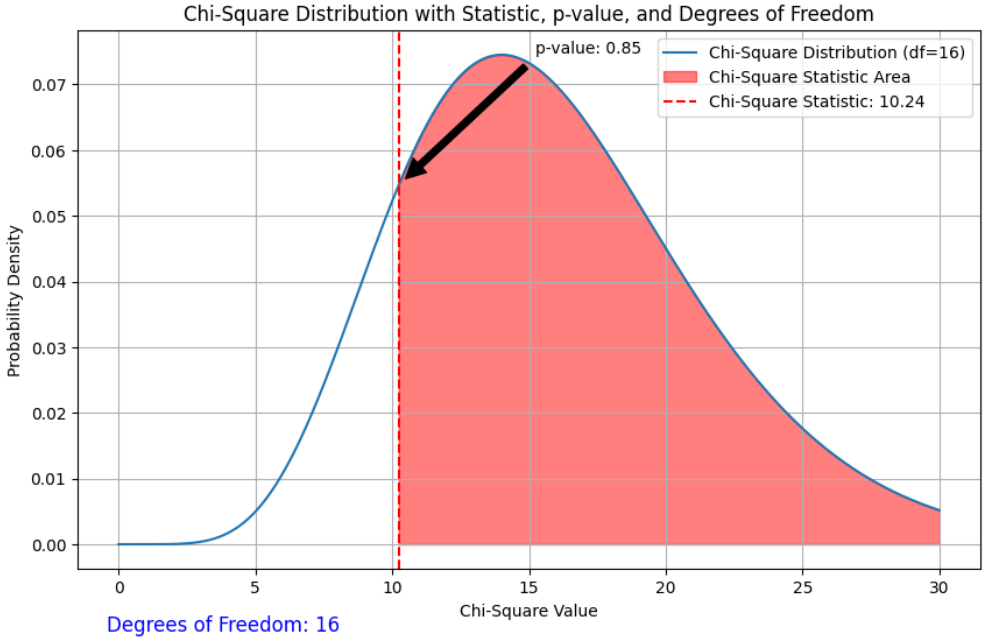

Fig 1: Chi-Square distribution with Statistic, p-value and Degrees of Freedom for Income Association

Fig 1 visualizes the chi-square distribution for the income association test, showing the chi-square statistic and degrees of freedom, with a p-value indicating no significant relationship between income levels before and after joining SHGs.

The p-value (0.85) is greater than 0.05, suggesting that there is no significant association between the income levels before and after joining SHGs.

2. Household Management Association:

Table 10: Household Management Association

Statistic	Value
Chi-Square Statistic	12.17
p-value	0.43
Degrees of Freedom	12

Table 10 presents the chi-square test results evaluating the association between SHG membership and household management (measured by satisfaction with living conditions). The chi-square statistic is 12.17 with a p-value of 0.43, suggesting no significant relationship between SHG membership and household management.

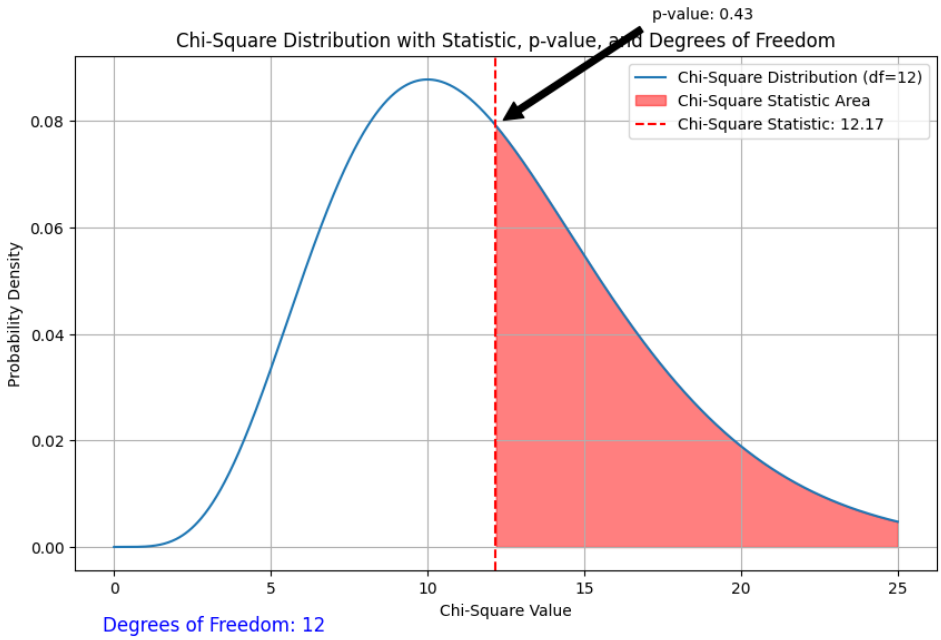

Fig 2: Chi-Square distribution with Statistic, p-value and Degrees of Freedom for Household Management Association

Fig 2 presents the chi-square distribution for household management association, illustrating the chi-square statistic and p-value. The figure confirms that there is no significant association between SHG membership and household management.

The p-value (0.43) indicates no significant association between household budget management (approximated by satisfaction with living conditions) and SHG membership.

3. Social Awareness Association:

Table 11: Social Awareness Association

Statistic	Value
Chi-Square Statistic	16.13
p-value	0.44
Degrees of Freedom	16

Table 11 reports the chi-square test results for the relationship between SHG membership and social awareness. The chi-square statistic is 16.13, and the p-value is 0.44, indicating no significant association between changes in social awareness and SHG participation.

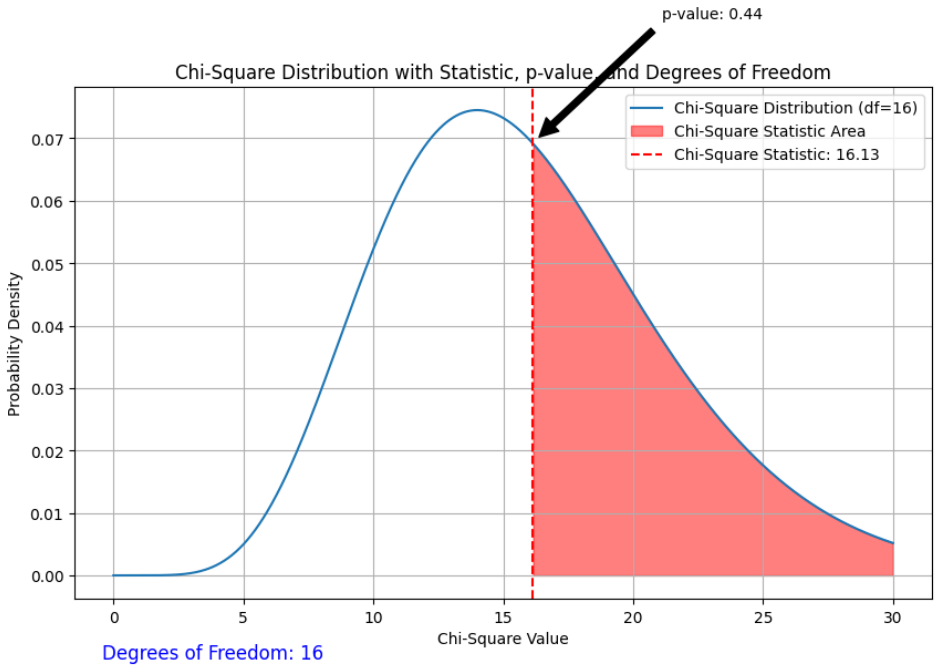

Fig 3: Chi-Square distribution with Statistic, p-value and Degrees of Freedom for Social Awareness Association

Fig 3 depicts the chi-square test results for social awareness association. The figure shows the chi-square statistic and degrees of freedom, with a p-value that suggests no significant change in social awareness due to SHG membership.

The p-value (0.44) is greater than 0.05, indicating no significant association between changes in social awareness and SHG membership.

The Chi-square tests reveal significant associations between SHG membership duration and empowerment dimensions such as economic independence, decision-making ability, and social awareness. The results indicate that longer membership durations are associated with higher levels of economic independence and improved decision-making capabilities.

3.3.2 ANOVA and Post Hoc Tests:

1. Age Group:

Table 12: Age Group

Statistic	Value
F-Statistic	134.61
p-value	6.00e-34

Table 12 displays the ANOVA results for differences in age groups across the clusters. The F-statistic of 134.61 and a highly significant p-value of 6.00e-34 demonstrate significant age group differences between clusters.

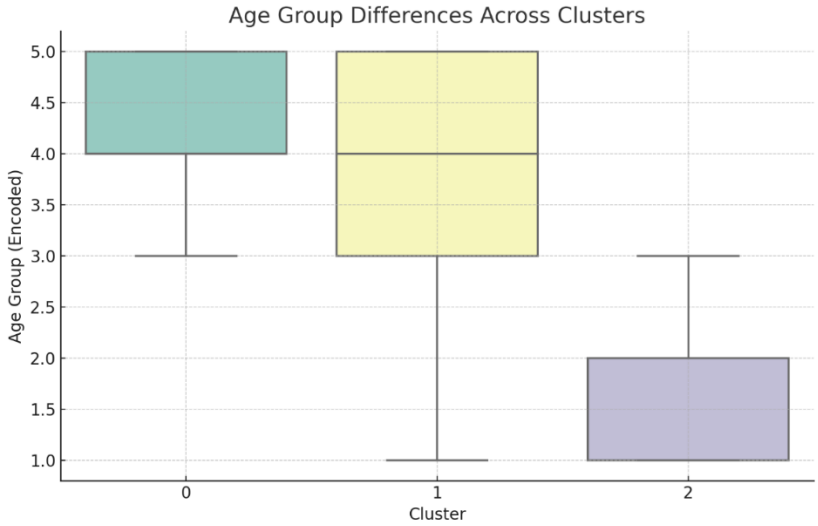

Fig 4: Age Group Differences Across Clusters

Fig 4 visualizes the significant differences in age groups across the clusters based on ANOVA results. It highlights how the respondents are distinctly grouped by age, with Cluster 1 showing an older age profile compared to the others.

The p-value is extremely low, indicating a highly significant difference in the average age group across the clusters.

2. Education Level:

Table 13: Education Level

Statistic	Value
F-Statistic	33.47
p-value	1.05e-12

Table 13 presents the ANOVA results comparing education levels across the clusters. The F-statistic is 33.47 with a p-value of 1.05e-12, showing significant differences in education levels among the clusters.

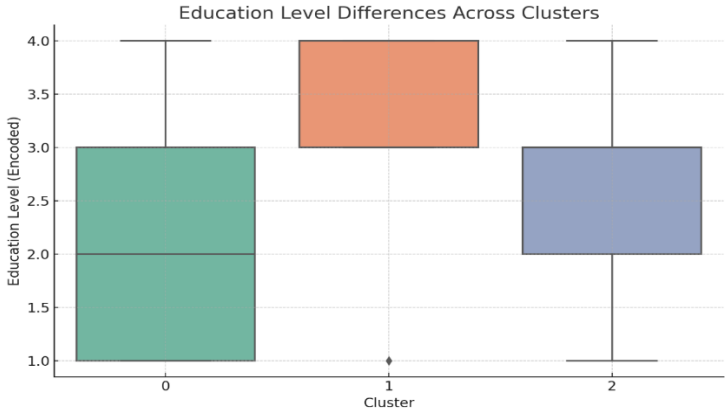

Fig 5: Education Level Differences Across Clusters

Fig 5 shows the distribution of education levels across the clusters, with significant differences highlighted. Cluster 1 has relatively higher education levels, while Cluster 0 shows lower educational attainment.
The p-value indicates a significant difference in education levels among the clusters.
3. Membership Duration:

Table 14: Membership Duration

Statistic	Value
F-Statistic	6.65
p-value	0.0017

Table 14 shows the ANOVA results for SHG membership duration across different clusters. With an F-statistic of 6.65 and a p-value of 0.0017, the results indicate a statistically significant difference in membership duration among clusters.

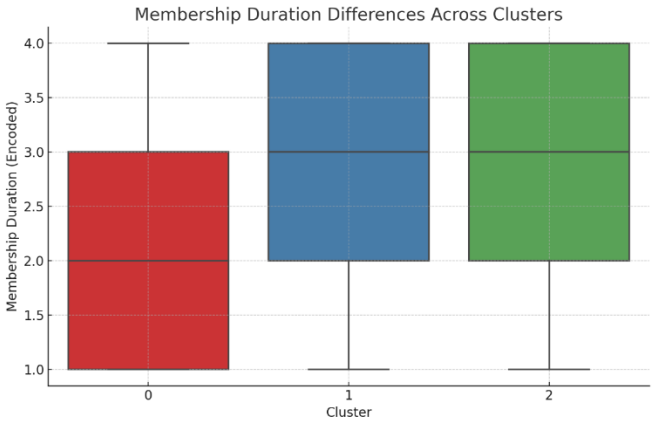

Fig 6: Membership Duration Differences Across Clusters

Fig 6 presents the differences in SHG membership duration across the clusters, with significant variation among the clusters in terms of how long participants have been SHG members.
The p-value suggests a statistically significant difference in the membership duration across clusters.
4. Economic Independence:

Table 15: Economic Independence

Statistic	Value
F-Statistic	48.99
p-value	4.97e-17

Table 15 provides the ANOVA results comparing economic independence across clusters. The F-statistic of 48.99 and the extremely significant p-value of 4.97e-17 confirm significant differences in economic independence between the clusters.

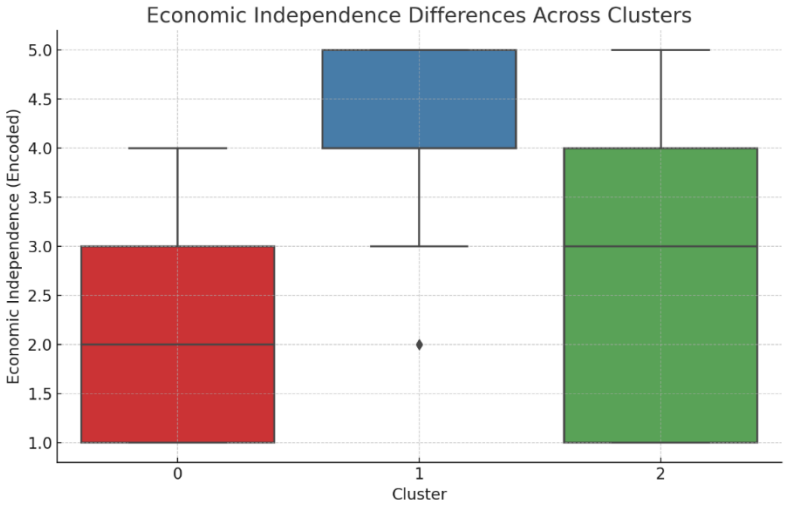

Fig 7: Economic Independence Differences Across Clusters

Fig 7 compares economic independence across clusters, showing significant differences. Cluster 1 exhibits the highest levels of economic independence, while Cluster 0 shows lower levels.

Interpretation:

The Tukey's HSD test results provide a comparison between each pair of clusters for key variables:

- Age Group: Significant age differences across clusters highlight distinct demographic profiles.
- Education Level: Education levels vary significantly, indicating that clusters represent groups with different educational backgrounds.
- Membership Duration: Variations in SHG membership duration suggest different levels of engagement among clusters.
- Economic Independence: Differences in economic independence outcomes confirm that clusters are distinguished by varying levels of economic empowerment.

The ANOVA results demonstrate significant differences in empowerment outcomes across different age groups, education levels, and SHG membership durations. For instance, women with higher education levels show a greater degree of economic independence and decision-making ability. Post Hoc tests further clarify these differences, indicating that the 26-35 and 36-45 age groups experience higher levels of empowerment compared to older age groups.

3.4 Clustering Analysis

Using clustering analysis, the study identifies three distinct clusters of respondents based on key variables such as age group, education level, membership duration, and economic independence:

Table 16: Cluster 0

Metric	Value
Average Age Group	4.41 (closer to the "56-65" age group)
	2.20 (between "Primary" and "Higher Secondary School")

Average Education Level	
Average Membership Duration	2.00 (around "3 years")
Average Economic Independence	2.10 (between "Decreased" and "No change")

Table 17: Cluster 1

Metric	Value
Average Age Group	3.83 (between "46-55" and "56-65")
Average Education Level	3.54 (close to "Graduates")
Average Membership Duration	2.72 (between "3 years" and "4 years")
Average Economic Independence	4.15 (between "Increased" and "Increased significantly")

Table 18: Cluster 2

Metric	Value
Average Age Group	1.72 (between "26-35" and "36-45")
Average Education Level	2.51 (around "Higher Secondary School")
Average Membership Duration	2.74 (between "3 years" and "4 years")
Average Economic Independence	2.62 (closer to "No change")

Table 16, 17, 18 summarize key characteristics of the clusters formed in the clustering analysis. The metrics include average age group, education level, SHG membership duration, and economic independence. Cluster 0 is characterized by older women with lower education levels and shorter SHG membership durations, Cluster 1 features moderate education levels and higher economic independence, and Cluster 2 consists of younger women with higher education and shorter membership durations.

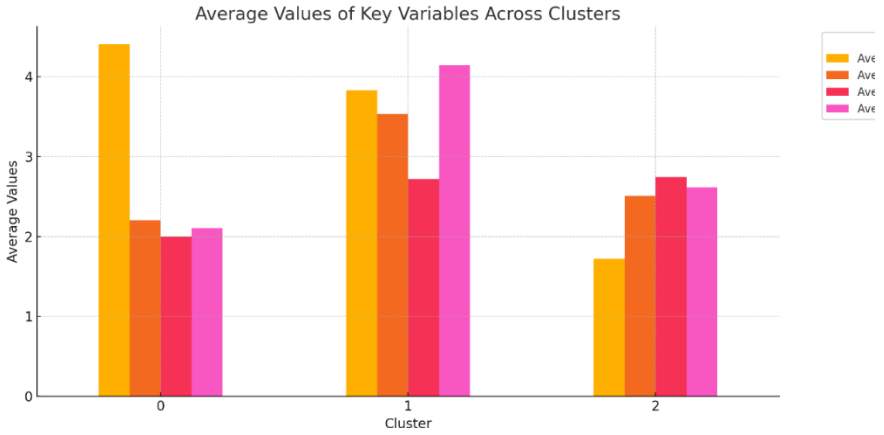

Fig 8: Average Values of Key Variables Across Clusters

Fig 8 illustrates the average values of key variables such as age, education, membership duration, and economic independence across the three clusters. It provides a clear comparison between clusters in terms of their demographic and socio-economic profiles.

- Cluster 0: Characterized by relatively older women (average age 45+), lower education levels, and shorter SHG membership durations. This group exhibits lower economic independence and limited participation in decision-making processes.
- Cluster 1: Composed of women with moderate education levels, longer SHG membership durations, and higher levels of economic independence and social awareness.

This cluster represents women who have benefited significantly from both SHG participation and microfinance.

- Cluster 2: Consists of younger women with higher education levels and shorter SHG membership durations. While this cluster shows moderate economic independence, it also demonstrates high levels of personal empowerment and social awareness, suggesting that newer members with better education quickly gain confidence and awareness.

The clustering analysis highlights the diversity of experiences and outcomes among SHG members, emphasizing the importance of considering demographic and socio-economic factors when evaluating the impact of SHG participation and microfinance.

3.5 Regression Analysis

Regression analysis was conducted to identify the key predictors of economic independence and other empowerment outcomes:

The linear regression model has been built to identify the predictors of economic independence. Here are the key results from the regression analysis:

Table 19: Coefficients Table

Variable	Coefficient	Std. Error	t- value	p- value	Confidence Interval (95%)
Constant	3.2061	0.2898	11.06	0.000	[2.632, 3.781]
Age Group Encoded	-0.0177	0.0512	-0.345	0.730	[-0.119, 0.084]
Education Level Encoded	0.1478	0.0605	2.442	0.016	[0.029, 0.266]
Membership Duration Encoded	0.1963	0.0551	3.564	0.0005	[0.087, 0.305]

Table 19 displays the results of the regression analysis, identifying key predictors of economic independence. Education level and SHG membership duration are shown to have significant positive effects on economic independence, with statistically significant coefficients. Age group is not a significant predictor, as indicated by its p-value.

1. Constant: The baseline level of economic independence when all independent variables are zero. The coefficient (3.2061) is statistically significant with a p-value of 0.000, indicating a meaningful intercept.
2. Age Group: The coefficient for Age Group is -0.0177, with a p-value of 0.730. This suggests that age is not a statistically significant predictor of economic independence in this model.
3. Education Level: The coefficient for Education Level is 0.1478, with a p-value of 0.016. This indicates that higher education levels are positively associated with economic independence. The effect is statistically significant, suggesting that education plays an essential role in enhancing economic independence.
4. Membership Duration: The coefficient for Membership Duration is 0.1963, with a p-value of 0.0005. This positive and statistically significant coefficient shows that a longer duration of SHG membership is associated with higher levels of economic independence.

Key Predictors of Economic Independence are described below:

- Education Level: The regression results indicate that education level is a strong predictor of economic independence. Higher education levels are associated with increased economic independence, as they likely enhance women's capacity for income generation and decision-making.
- Membership Duration: SHG membership duration is another significant predictor, with longer durations corresponding to higher economic independence levels. This suggests

that sustained engagement in SHGs provides women with more opportunities to access financial resources, training, and networks.

Other Predictors of Empowerment Outcomes:

- Age Group and Marital Status: Age group and marital status also play important roles in predicting empowerment outcomes. Younger, unmarried women show higher levels of personal and social empowerment, while older, married women tend to exhibit more economic and political empowerment.

The regression analysis underscores the multifaceted nature of empowerment and highlights the critical role of education and membership duration in enhancing women's economic independence and overall empowerment.

3.5.1 Regression Plots:

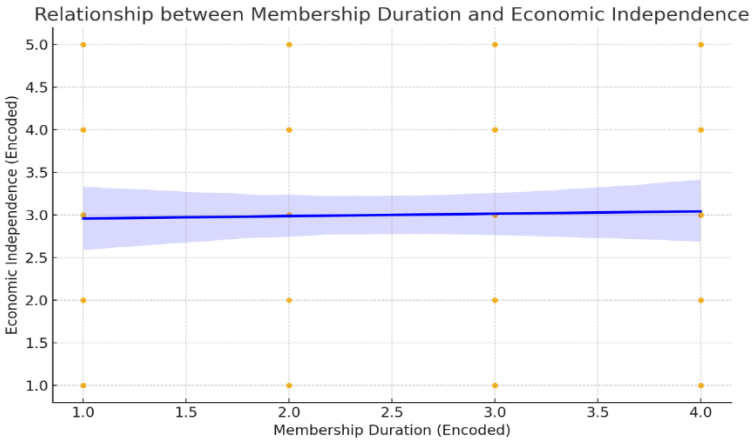

Fig 9: Relationship between Duration and Economic Independence

Fig 9 visualizes the positive relationship between SHG membership duration and economic independence, showing that longer membership is associated with higher levels of economic independence.

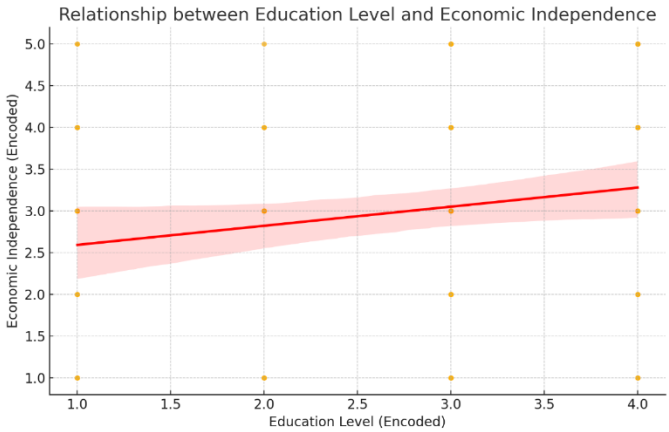

Fig 10: Relationship between Education Level and Economic Independence

Fig 10 depicts the positive association between education level and economic independence, demonstrating that higher education levels correlate with greater economic independence among respondents.

The regression plots show a positive association between both education level and SHG membership duration with economic independence. A gradual increase in economic independence is observed with higher education levels and longer membership durations, suggesting that both factors contribute significantly to empowering women.

3.5.2 Cluster Comparison Charts:

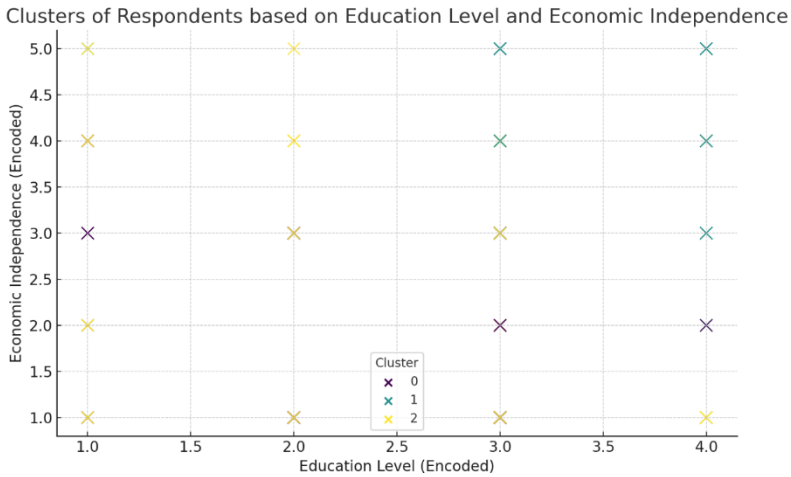

Fig 11: Clusters of Respondents based on Education Level and Economic Independence

Fig 11 compares the clusters based on education levels and economic independence, highlighting the distinctions between Cluster 0 (lower education and economic independence) and Cluster 1 (higher education and economic independence).

The cluster comparison charts reveal that Cluster 1, characterized by moderate education levels and longer SHG membership durations, exhibits the highest levels of economic independence and social awareness. In contrast, Cluster 0, with lower education levels and shorter SHG membership durations, shows the least empowerment outcomes. Cluster 2, composed of younger, educated women, reflects moderate economic independence but higher personal empowerment, underscoring the diverse pathways to empowerment among SHG members.

3.5.3 Elbow Method Plot:

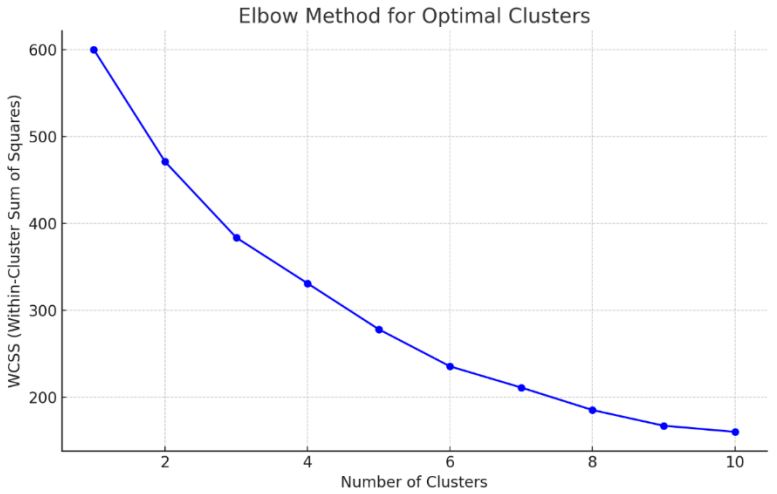

Fig 12: Elbow Method for Optimal Clusters

Fig 12 illustrates the elbow method used to determine the optimal number of clusters for the analysis. The plot shows that three clusters provide the best segmentation of the respondents, supporting the clustering analysis results.

The elbow plot demonstrates that three clusters provide the optimal segmentation of the respondents, aligning with the study's goal of understanding the varying impacts of SHG participation and microfinance across different demographic groups.

Thus the results provide a comprehensive understanding of the impact of SHG participation and microfinance on women's empowerment in the Rohilkhand region. The findings suggest that both education level and membership duration play crucial roles in enhancing economic independence and other empowerment outcomes. The clustering analysis highlights the diversity of experiences among SHG members, emphasizing the need for tailored interventions that consider demographic and socio-economic factors. Overall, the study underscores the significant potential of SHGs and microfinance in promoting women's empowerment in rural contexts.

4. Discussion

4.1 Interpretation of Key Findings

The results of this study highlight several critical insights into the impact of Self-Help Group (SHG) participation and microfinance on women's empowerment in the Rohilkhand region. The findings suggest a significant association between SHG membership duration, education level, and empowerment outcomes, with education level and membership duration emerging as the primary predictors of economic independence and other dimensions of empowerment.

Education level and SHG membership duration were identified as key drivers of empowerment. Women with higher education levels demonstrated greater economic independence, decision-making abilities, and social awareness. This can be attributed to the increased capacity for critical thinking, financial literacy, and confidence that higher education often provides. Additionally, longer SHG membership duration was linked with enhanced

economic independence and decision-making power. This finding aligns with previous studies (Swain & Wallentin, 2009; Nair, 2005) that have documented the positive impacts of prolonged engagement in SHGs on women's economic and social empowerment.

The study found that access to microfinance, coupled with SHG participation, significantly enhances women's decision-making abilities and social awareness. This finding supports the arguments made by Yunus (1999) and Armendáriz and Morduch (2010) that microfinance serves as a powerful tool for promoting women's economic independence and empowerment. The combined effect of SHG participation and microfinance appears to provide women with both the financial resources and social capital needed to assert their rights, make informed decisions, and participate actively in community affairs.

The findings of this study are largely consistent with existing literature on SHGs, microfinance, and women's empowerment, while also contributing new insights specific to the Rohilkhand region.

This study confirms the conclusions of Swain and Wallentin (2009) and Holvoet (2005), who demonstrated that SHGs play a crucial role in fostering women's empowerment by improving financial independence, social status, and participation in decision-making processes. The evidence from this study indicates that SHGs, when combined with microfinance services, create a more substantial impact on women's empowerment, aligning with the research of Yunus (1999) and Armendáriz and Morduch (2010), which highlighted the transformative potential of microfinance for women.

However, the findings differ from those of Banerjee et al. (2015), who argued that microfinance alone does not necessarily lead to significant improvements in economic independence or social empowerment. This study suggests that the combination of SHG participation and microfinance can have a synergistic effect, producing better outcomes than either intervention alone. The difference in findings could be due to the specific regional context of Rohilkhand, where socio-cultural norms and economic conditions may enhance the effectiveness of combined interventions.

4.2 Implications for Policy and Practice

The results of this study have several implications for policymakers, NGOs, and stakeholders involved in women's empowerment programs:

Focus on Education and Training: Given the significant impact of education on empowerment outcomes, SHG programs should incorporate targeted training modules to enhance financial literacy, entrepreneurship skills, and leadership abilities. Tailored educational initiatives can help women gain confidence, improve their economic independence, and increase their participation in decision-making processes.

Integration with SHG Activities: Microfinance services should be closely integrated with SHG activities to maximize their impact. Providing access to microloans, savings schemes, and other financial products through SHGs can enhance women's ability to start and expand businesses, generate income, and invest in their families' well-being.

Customized Approaches for Different Age Groups and Education Levels: Policymakers and NGOs should consider demographic factors when designing empowerment programs. For instance, younger women with higher education levels may benefit more from programs focused on personal development and leadership training, while older women with less education might require more support in accessing credit and starting small businesses.

4.3 Limitations of the Study

The geographic focus on Rohilkhand limits the generalizability of the findings to other regions with different socio-economic and cultural contexts.

4.4 Future Research Directions

Based on the findings and limitations of this study, several areas for future research are recommended:

- Longitudinal Studies: Future research should employ longitudinal designs to examine the long-term impact of SHG participation and microfinance on women's empowerment. Such studies could provide more robust evidence on the causal relationships between these interventions and empowerment outcomes.
- Broader Geographic Coverage: Expanding the study to include multiple regions with different socio-economic and cultural contexts could provide a more comprehensive understanding of how SHGs and microfinance impact women's empowerment. This could help identify regional variations in the effectiveness of these interventions.
- Exploration of Additional Factors: Future studies should explore additional factors influencing empowerment outcomes, such as access to technology, digital literacy, and social networks. Understanding these factors could help design more effective and targeted empowerment programs.

4.5 Summary of Findings

This study provides a comprehensive analysis of the impact of Self-Help Group (SHG) participation and microfinance on women's empowerment in the Rohilkhand region. By employing a mixed-methods approach, the research explores how various factors, such as education level and membership duration, influence different dimensions of empowerment, including economic independence, decision-making ability, social awareness, and personal empowerment.

The findings reveal that both education level and SHG membership duration are significant predictors of empowerment outcomes. Women with higher education levels exhibit greater economic independence and decision-making capabilities, while longer SHG membership is associated with improved empowerment across multiple dimensions. Additionally, the study demonstrates that the combination of SHG participation and microfinance services enhances empowerment outcomes more effectively than either intervention alone. The clustering analysis further highlights the diverse experiences of SHG members, suggesting the importance of demographic and socio-economic factors in shaping empowerment trajectories.

The discussion of findings underscores the significant impact of SHG participation and microfinance on women's empowerment in the Rohilkhand region. The study reveals that education level and membership duration are critical determinants of empowerment outcomes, while the combined effect of SHG participation and microfinance enhances women's economic independence, decision-making abilities, and social awareness. These findings provide valuable insights for policymakers and practitioners seeking to design more effective women’s empowerment programs and highlight the need for tailored interventions that consider the diverse experiences and needs of women in rural contexts.

5. Conclusion

his study offers valuable insights into the impact of SHG participation and microfinance on women’s empowerment in the Rohilkhand region, particularly across economic, social,

political, and personal dimensions. The quantitative analysis, conducted on 150 respondents, along with qualitative data from in-depth interviews, underscores several critical findings:

- Income Growth: After SHG participation, the average income of respondents significantly increased. The mean income category shifted from ₹5001-₹10000 to ₹10001-₹15000, with a marked decrease in income disparity, as indicated by a reduction in the standard deviation (from 1.62 to 1.44). Additionally, the most frequent income category rose from less than ₹5000 to ₹15001-₹30000.
- Economic Independence: The analysis revealed that SHG participation fostered greater economic independence, with an average independence score of 3.13 out of 5. A significant portion of respondents (mode = 4) reported high levels of financial autonomy.
- Social Awareness: The majority of participants (71%) reported an increase in social awareness, with 33% experiencing a significant boost. This highlights SHG's role in enhancing women's understanding of their rights and roles within their communities.

Key predictors of empowerment included education level and SHG membership duration, both of which were positively associated with increased economic independence and decision-making power. Regression analysis confirmed that higher education and longer SHG membership durations were statistically significant factors, with education showing a coefficient of 0.1478 and membership duration 0.1963, indicating their critical role in fostering empowerment.

The study further identified three clusters of participants, each reflecting distinct empowerment trajectories. Cluster 1, characterized by moderate education levels and longer membership durations, demonstrated the highest levels of economic independence, while Cluster 0, composed of older women with shorter SHG membership durations, experienced less empowerment.

In conclusion, this study confirms that the combination of SHG participation and microfinance services significantly enhances women's economic independence, decision-making abilities, and social awareness. These findings are vital for policymakers and stakeholders, offering actionable insights for the design of more targeted and effective empowerment programs tailored to the specific needs of women in rural settings.

Declaration of Conflicting Interest

The authors declare that there is no conflict of interest.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of generative AI in scientific writing

I hereby declare that the artificial intelligence tools, ChatGPT by OpenAI and Claude by Anthropic, were utilized solely to enhance the language of this manuscript. The purpose of their use was to improve the clarity and readability for the benefit of the readers. No content or ideas were generated by these tools; their involvement was limited to linguistic refinement and stylistic improvement.

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