

The Influence of Non-Economic Domain on the Economic Domain of Empowerment: A Study on Neural Networks of Women Self-Help Groups

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Abstract:

The paper aims to understand the effect of non-economic domains of empowerment on the economic empowerment of women after joining the self-help groups. Most of the studies focused on analysing the level of empowerment in various domains but there is relatively paucity of studies of SHGs showing the effect of non-economic domains in respect of influencing the economic domain of empowerment in the Indian context. The present study contributes to fill the gap in the literature. The paper used data of 200 women from South block of Golaghat district, Assam to fulfil the objectives of the paper. The data were analysed in two stages: testing the hypothesis through Wilcoxon signed rank test followed by Artificial Neural Networks. In conclusion, our findings suggest that the primary benefit of the establishment of Self-Help Groups (SHGs) is the empowerment of women, who are significantly impacted by psychological, educational, political, and social spheres of empowerment which holistically impacts the economic empowerment following their participation in the Self-Help Groups.

Keywords: *Economic, neural networks, non-economic, self-help groups, women empowerment.*

1. INTRODUCTION

The beginning of microfinance has been recognized as a tremendous response across the globe. Ever since then, the programs have been increasing to end the era of feminization of poverty (Khan et al., 2020). The idea of implementing empowerment in the lives of women is considered to be crucial for the development of a nation. It was first aroused at the World's Women's Conference in 1975 where gender equality was addressed along with their rights promoting participation and advancement¹. India adopted it by highlighting and formulating its objective to raise income and protection of women in its Fifth Five Year Planning (1974-79). It resulted in representing women's needs under the establishment of the Ministry of Social Welfare, Women's Welfare and Development Bureau in 1976 (De. 2021). Moving forward in this direction, an initiative was taken by Self Employed Women's Association (SEWA) to improve the economic status of women. In addition to this, an effective strategy was developed by NABARD popularly known as Self-help groups. The programs were designed with the aim of increase in income, consumption, and

expenditure by implementing autonomy among women around the state (Rahman et al., 2009, Panda, 2009).

The intention to break the vicious circle of poverty with the approach of building their capacity helped millions of households to gain better access to savings and credit (Sarkar and Chattopadhyay, 2018). The process also promotes working and helping each other collectively, and educates them economically by raising their status in society through the proper mobilization of resources (Moyle et. al., 2006). The breakthrough progress of women involved in it has gained the interest of various researchers and academicians to evaluate the process and journey towards empowering women and their lives involved around it. The developmental circle of empowerment was envisioned as a process of challenging patriarchal roles, and ideologies justifying social inequality, fostering power, and social and individual changes (Batiwala, 2007, Page & Czuba, 1999). Later on, the term was stretched to use proxy measures like employee empowerment, social and cultural issues, economic conditions, acquisition of assets, social

¹ Source: <https://www.unwomen.org/en/how-we-work/intergovernmental-support/world->

[conferences-on-women](https://www.unwomen.org/en/how-we-work/intergovernmental-support/world-conferences-on-women) accessed on 18/05/2023 at 11.11 A.M

capital, and sustainable women empowerment (Bushra and Wajiha, 2015) (Varghese, 2011) (Pal et al., 2022).

Microfinance programs were designed to target the vulnerable sections of society. What lies beneath are the reasons to foster economic growth and bring forward the nations to development. Researchers around the globe have viewed economic empowerment as a multi-dimensional concept measured in different ways. Wide interpretations find it difficult to measure the evaluation of empowerment among women, while some define it as a process or put together as indicators of empowerment (Gram et al., 2019). Much of the existing works of literature used financial inclusion, decision-making capacity, opportunities for employment, bargaining power, and so on as variables to measure the progress of economic empowerment. (Pal et. al., 2022) (Sarania, 2015). Some believe women take up different economic activities that are new to them or somewhere they possess an ample amount of experience or are firmly defined for women's domain only (Hailu Alemu, 2018). Thus, economic empowerment can be defined as the power to make and act on decisions through various skills and resources to advance economically by earning profits (Golla et al., 2011). There is overwhelming evidence of SHGs participating all over the world in the Indian scheme. Moyle et al., (2006) explored the link between economic and personal empowerment in Rural India where they emphasized the significance of income generation, entrepreneurship, and financial independence for women having greater control over their lives with increased decision-making power, agency and autonomy as personal factors for their individual and well-being of households. They discussed the collective nature of women in SHGS helps them to share their knowledge, and provides them mutual support by pooling various sources of resources to enhance the economic status of women. A thematic analysis of the role of microfinance and SHGs on financial inclusion highlights SHGs as a platform and empowerment as an outcome noting that despite

having several developments, the vulnerable sections are still unable to access resources as those men facing challenges have limited financial resources, lack of infrastructure and various information through training and capacity building (Kandpal, 2022). Participation in the groups is found to be quite effective at the community level but does not translate similarly within the domain of the household. The measurement of empowerment was incorporated as an after-effect or outcome, not as a theory of change. Women need to have an empowered state of mind for adopting economic decisions in their individual as well as household outcomes of alleviating poverty (Fox & Romero, 2017). It has been seen for them to gain more access in enhancing economic activity to others (*power with*) and lesser control towards income generating activities or employment and, financial or knowledge-based assets (*power over*) and, economic decision-making capacity with households or markets (*power to*) (S.H Alemu et al., 2018. Pereznieta and Taylor, 2014). The lesser control is due to less capacity and capability of members, and lesser entrepreneurial and professional skills to get engaged into income generating activities (Nikhitha & Prabhakar, 2022).

Various policies and programs have enabled women to access finance that can lead to the development of the economy but women in our country aren't aware of the potentialities in the context of rural areas. According to a survey by UNDP's Multi-Dimensional Poverty Index 2021², Assam ranks 5th depriving the basic amenities of health, education, standard of living, and so on. There is a need to identify the barriers and constraints that led to women's contribution being inadequately addressed. Hence, the present study digs into whether the non-economic domains of empowerment influence the economic domain in the lives of women participating in various self-help groups of Golaghat district of Assam.

The paper contributes by arguing that women empowerment takes place among women participating in various SHGs which influences their

² Source: [https://www.sentinelassam.com/north-east-india-news/assam-news/after-meghalaya-assam-is-the-poorest-state-in-the-northeast-](https://www.sentinelassam.com/north-east-india-news/assam-news/after-meghalaya-assam-is-the-poorest-state-in-the-northeast-according-to-the-niti-aayog-565124)

[according-to-the-niti-aayog-565124](https://www.sentinelassam.com/north-east-india-news/assam-news/after-meghalaya-assam-is-the-poorest-state-in-the-northeast-according-to-the-niti-aayog-565124) accessed on 4th June 2023 at 2.30 p.m

societal relationships, and individual well-being, improving their level of education regarding their work preferences and improving their leadership and political skills and makes them capable of developing their skills economically. The observance of women's empowerment is considered in the comparison of the change in women of pre- and post-joining the groups. Previous studies have zoomed into a picture of SHGs having a strong economic component influencing the collective economic activity and generation of income among households (Singh, 2013, Jena, 2023), the effectiveness of economic or non-economic factors on women's empowerment (Vijaykumar, 2017³) but there is relatively paucity of studies of SHGs showing the effect of non-economic domains in respect of influencing the economic domain of empowerment in the Indian context. We have assumed an indirect and unknown relationship between the independent and dependent variables that cannot be predicted in a straight line popularly known as Artificial Neural Networks (ANN). It is used to represent and predict the complex relationships processed by a human brain through hidden layers.

The study presents to serve the following objectives:

1. To understand the level of empowerment on women before and after joining the self-help groups
2. To understand the effect of non- economic domains of empowerment on the economic empowerment of women after joining the groups. The above given objectives will be fulfilled with the working hypothesis:

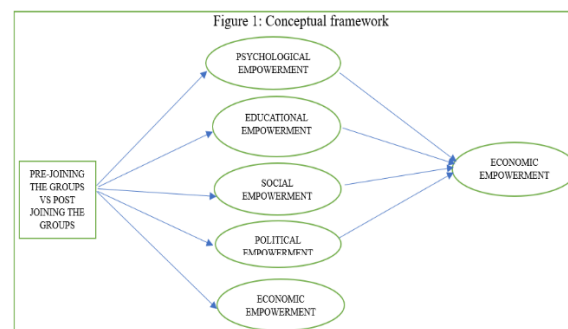
1. There are no significant differences in the level of empowerment in various domains among the women members after joining the self-help groups.

The paper is organized in three sections presenting a conceptual framework of the study in Section 3. Section 4 describes the research methodology along with its analysis of data. The final section

(Section 5) gives a glance at the results through its conclusions.

2. CONCEPTUAL FRAMEWORK OF THE STUDY

The present paper proposes a design to understand the impact of non-economic dimensions of empowerment on the economic empowerment of women involved in various self-help groups. Figure 1 presents the conceptual framework for the study given below:



Source: Constructed by the researcher

The framework aims to understand the influence of various domains of empowerment among women in self-help groups. In the first part of the study, empowerment is measured by comparing it to empowerment gained before joining the groups vs after joining the groups. The latter part of the study tried to explore psychological empowerment, educational empowerment, social empowerment and political empowerment serving altogether as independent variable to the economic domain i.e., economic empowerment which is the dependent variable of the study.

3. RESEARCH METHODOLOGY

This study has been conducted in the district of Golaghat, Assam, and has utilized structured questionnaire responses to collect primary data from Women Self-Help Groups (SHGs) registered under the National Rural Livelihood (NRL) Mission. Subsequently, secondary data was collected from various sources, including books, journals, websites, block offices, and regional offices of NRLM. Random sampling has been applied in the study.

³ Source:

https://sjcc.edu.in/siccresearch/pdf/ugc_poornima_17.pdf accessed on 3rd June 2023 at 7.25 p.m

The total number of analysed responses represents 200 women self-help groups of the South Block of Golaghat district of Assam. In order to assess the empowerment of women before and after joining the groups' reliability analysis have been measured

to determine the internal consistency followed by Wilcoxon signed rank test.

3.1 ANALYSIS OF DATA

Demographic Profile:

Table 1: Demographic Profile of Respondents

Basis	Description	N	Frequency (%)
Age	18 – 25 years	30	15
	26 – 35 years	50	25
	36 – 45 years	70	35
	46 – 55 years	35	17.5
	55 and above	15	7.5
Education	No Education	23	11.5
	Elementary Education	97	48.5
	Senior Secondary Education	43	21.5
	Degree	30	15
	Post Graduate	07	3.5
Occupation	Agriculture	55	27.5
	Labourers	32	16
	Animal Husbandry	59	29.5
	Small Business	37	18.5
	Unemployed	17	8.5

Source: Primary data

Table 1 presents the demographic profile of the women respondents of various self-help groups. It is found that majority of the women lies within the age group of the age groups of 26 to 45 years (25%), with the highest concentration in the 36 to 45 years category (35%). The younger age group (18 to 25 years) also has a notable presence, while the older age group (55 and above) has the smallest representation among SHG women.

The educational status of the respondents signifies that 48.5% women members have the basic elementary education followed by 21.5% of senior secondary education. 11.5% women do not possess no educational background, while 15% women are graduate followed by only a minimum of 3.5% of having higher educational qualification of having post-graduation degree.

Occupational status is another demographic characteristic to determine the type of income generating activities paving the way to economic capacity. It is evident from the above table that majority of the women (29.5%) were involved in

animal husbandry followed by 27.5% in agriculture i.e., vegetable farming, paddy cultivation and other agricultural activities. 18.5% women were involved in small business i.e., having small grocery shops in front of their homes, selling products online, selling homemade items to shops and door to door selling etc. 16% women were working as labourers in tea gardens or in factories or as construction workers. It is notable that only 8.5% women who were unemployed were involved as members in the groups.

Reliability Analysis:

The present study applies to determine the internal consistency of the various domains of empowerment along with the indicators measuring the effect of empowerment within each level. Hence the study applies the reliability measurement of Konting et al., (2009) to measure the accuracy of the instruments used for the study. Table 1 demonstrates the results of the reliability analysis.

To measure the impact of psychological empowerment in women before joining the self-help groups, we considered the factors of ability to work, self-control on work, sense of work-control, and active involvement in groups as variables to measure the consistency. The Cronbach Alpha in the present study before joining the groups is found to be .660 and post joining the self-help groups is .785 is good and acceptable (Refer Table 1). Hence, it is deemed to be reliable for this study. The variables considered for measuring the empowerment in terms of women's education are acquiring new knowledge and possessing the skills of learning, having the urge to gain new skills for pre joining the groups is .624 and .621 for post joining the groups which is reliable and hence adopted for the present study.

The Cronbach Alpha for the factors of social empowerment of having control over a social life, be a cause of change for society, and the ability to maintain social roles before joining the self-help

groups is .665 and after joining the groups is .645 which is found to be acceptable (Refer Table 1).

Similar are the findings for the factors such as having a focus on the working of groups, on the personal interest of the individuals, ability to interact with persons holding official positions regarding the group activities, and making democratic decisions on the groups for the political empowerment pre-joining the groups are found reliable at .739 while post-joining the groups is .574 which is a nonacceptable limit to be included in the study.

The economic empowerment shows a Cronbach alpha of .655 and .694 pre- and post-joining the groups respectively for the factors such as decision-making skills, acting on own decisions, capacity to allocate financial and economic resources, and developing economic skills is found to be acceptable for the present study.

Table 1: Values of reliability analysis for measuring the level of empowerment

Domains of Empowerment	Items	Cronbach Alpha	Remarks
Pre-Psychological Empowerment	4	.660	Acceptable
Post- Psychological Empowerment	4	.785	Good & Acceptable
Pre-Educational Empowerment	2	.624	Acceptable
Post--Educational Empowerment	2	.621	Acceptable
Pre-Social Empowerment	3	.665	Acceptable
Post-Social Empowerment	3	.645	Acceptable
Pre-Political Empowerment	4	.739	Good & Acceptable
Post-Political Empowerment	4	.600	Acceptable
Pre-Economic Empowerment	5	.655	Acceptable
Post-Economic Empowerment	5	.694	Acceptable

Source: Computed by the researcher

Table 2 shows the hypothesis testing of the various domains of empowerment using the Kolmogorov Smirnov test. Here, we can see a p-value <0.05 which provides considerable evidence to reject the null hypothesis that the factors follow the normal distribution.

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-Psychological Empowerment	.183	200	.000	.882	200	.000
Post-Psychological Empowerment	.232	200	.000	.833	200	.000
Pre-Educational Empowerment	.305	200	.000	.755	200	.000
Post-Educational Empowerment	.297	200	.000	.760	200	.000
Pre-Social Empowerment	.229	200	.000	.836	200	.000
Post-Social Empowerment	.402	200	.000	.634	200	.000
Pre-Political Empowerment	.180	200	.000	.863	200	.000
Post-Political Empowerment	.213	200	.000	.845	200	.000
Pre-Economic Empowerment	.152	200	.000	.919	200	.000
Post-Economic Empowerment	.183	200	.000	.875	200	.000
a. Lilliefors Significance Correction						
Source: Output by SPSS						

The responses of each domain from pre- and post-joining the groups with data were analysed non parametrically using Wilcoxon signed rank test. The test was selected due to the type of data and based on the rejection of normality having a normal distribution. Table 3 gives us a glimpse of the various domains of empowerment and their assigned ranks. It has been seen that the ranks representing positive effects of post-joining empowerment compared to pre-joining ones ranked higher having a minimal difference of negative and having no impact of empowerment among women members of SHG.

Table 3 Ranks				
		N	Mean Rank	Sum of Ranks
Total of the variables Pre & Post Psychological Empowerment	Negative Ranks	43 ^a	64.19	2760.00
	Positive Ranks	100 ^b	75.36	7536.00
	Ties	57 ^c		
	Total	200		
Total of the variables of Pre & Post Educational Empowerment	Negative Ranks	23 ^a	52.43	1206.00
	Positive Ranks	83 ^b	53.80	4465.00
	Ties	94 ^f		
	Total	200		
Total of the variables of Pre & Post Social Empowerment	Negative Ranks	19 ^a	37.45	711.50
	Positive Ranks	110 ^b	69.76	7673.50
	Ties	71 ^c		
	Total	200		
Total of the variables of Pre & Post Political Empowerment	Negative Ranks	53 ^a	68.71	3641.50
	Positive Ranks	85 ^b	69.99	5949.50
	Ties	62 ^c		
	Total	200		
Total of the variables of Pre & Post Economic Empowerment	Negative Ranks	52 ^a	62.51	3250.50
	Positive Ranks	115 ^b	93.72	10777.50
	Ties	33 ^c		
	Total	200		
a. Post Empowerment < Pre-Empowerment				
b. Post Empowerment > Pre-Empowerment				
c. Post Empowerment = Pre-Empowerment				

Table 4 Test Statistics ^b					
	Total of the variables of Pre & Post Psychological Empowerment	Total of the variables of Pre & Post Educational Empowerment	Total of the variables of Pre & Post Social Empowerment	Total of the variables of Pre & Post Political Empowerment	Total of the variables of Pre & Post Economic Empowerment
Z	-4.894 ^a	-5.339 ^a	-8.336 ^a	-2.493 ^a	-6.065 ^a
Asymp. Sig. (2-tailed)	.000	.000	.000	.013	.000
a. Based on negative ranks.					
b. Wilcoxon Signed Ranks Test					

Source: Output from SPSS

In order to evaluate the impact of psychological empowerment in women after joining the groups compared to pre-joining the groups, the performance of Wilcoxon signed rank test revealed a statistically significant positive changes after participating in the self-help groups where, $Z = -4.894$, $p = .000$ with a medium effect size according to Cohen (1988)⁴ of ($r = 0.34$). The measurement of the impact of educational empowerment in women of self-help groups revealed a statistically significant positive change with $Z = -5.339$, $p = .000$ with a medium effect size of ($r = 0.377$). Social empowerment showed a significant positive impact on the women after joining groups with $Z = -8.336$, p

$= .000$ and a larger effect size of ($r = 0.589$). The results of Wilcoxon test predicted positive results for the variables of political ($Z = -2.493$) and economic ($Z = -6.065$) empowerment with a p value ($= .013$, $.000$) and a smaller effect size of ($r = 0.17$, 0.42) respectively. Thus, the above results in Table 4 provide enough evidence to reject the null hypothesis by stating that the membership aroused from self-help groups has added greater positive after effects through psychological empowerment, educational empowerment and social empowerment having smaller impact of political and economic empowerment in the lives of women members participated on various self-help groups.

Table 5: Test statistics of Friedman Test

Domains	Mean Ranks	Chi-Square	df	Asymp. Sig
Pre- Psychological Empowerment	1.36	22.720	1	.000
Post- Psychological Empowerment	1.64			
Pre-Educational Empowerment	1.35	33.962	1	.000
Post- Educational Empowerment	1.65			
Pre- Social Empowerment	1.27	64.194	1	.000
Post- Social Empowerment	1.73			
Pre-Political Empowerment	1.42	7.420	1	.006
Post-Political Empowerment	1.58			
Pre-Economic Empowerment	1.34	23.766	1	.000
Post- Economic Empowerment	1.66			

Table 5 presents an overview of the variables of empowerment and found that psychological empowerment has Chi-square X^2 ($df = 1$, $N = 200$) = 22.720, educational empowerment of ($X^2 = 33.962$), social empowerment of ($X^2 = 64.194$), political empowerment ($X^2 = 7.420$) and economic empowerment ($X^2 = 23.766$) stating $p < 0.05$ which shows significant differences in the levels of empowerment among women members participated in various self-help groups except that of political empowerment.

6. RESULTS OF NEURAL NETWORKS ANALYSIS

The present paper seeks to analyse the relationship of economic empowerment with psychological, social, political and educational domains of empowerment using neural networks. The aim is to suggest a model to analyse the impact of non-economic empowerment on economic empowerment. Such a model could be useful for the policymakers as well as women to gain more financial access towards gaining economic independence

Table 1: Case Processing Summary of Samples

No of Rounds	Training Sample	Testing Sample	Valid Samples	Excluded	Total
Round 1	140 (70%)	60 (30%)	200	0	200

⁴ Source: Becker, L. A. (2000). Effect size (ES).

Round 2	130 (65%)	70 (35%)	200	0	200
Round 3	135 (67.5%)	65 (32.5%)	200	0	200
Round 4	142 (71%)	58 (29%)	200	0	200
Round 5	145 (72.5%)	55 (27.5%)	200	0	200

Source: Compiled by researcher from the output of SPSS

Table 1 shows the case processing summary of all the rounds where round 1 shows a total of 140 responses i.e., 70% were included in the training phase while 60 cases i.e., 60% went through the testing phase.

Round 2 gives an overview of 130 samples representing a total of 65% are used to train the data and that of 70 samples representing 35% of testing samples are used to build the model of ANN.

In Round 3 out of 200 cases, 135 samples i.e., 67.5% is used for the training of datasets. A total of 65 samples which holds to 32.5% of the total samples is used for the purpose of testing of datasets.

Round 4 shows the results of the data been trained and tested in samples during the process of partitioning. Around 142 samples i.e., 71% of samples are used for training and 58 samples are used for testing the samples.

Round 5 gives a glance of the total number of 200 samples been divided into training and testing phase with no excluded samples in it. A total of 72.5% presenting 145 samples are used to train the datasets keeping 27.5% i.e., 55 samples for the testing phase.

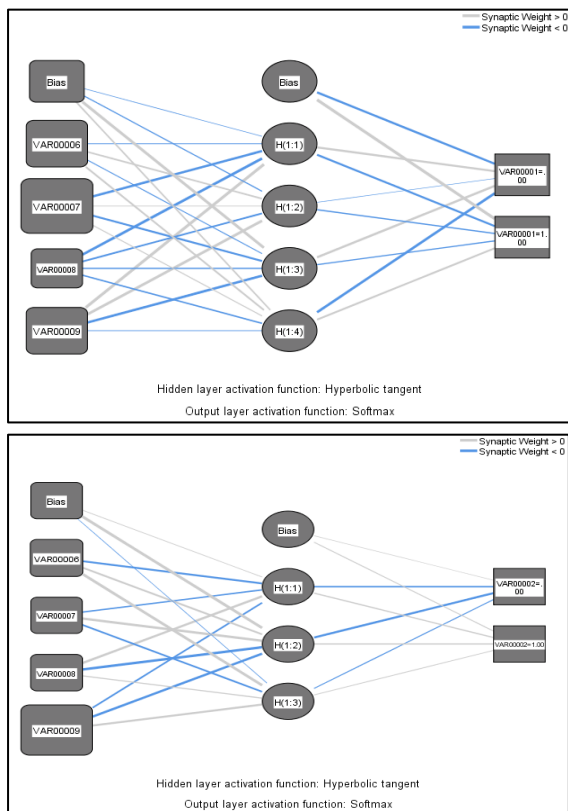
Input Layer	Covariates	1	Psychological Empowerment [AFTER-before]
		2	Educational Empowerment [AFTER-before]
		3	Social Empowerment [AFTER-BEFORE]
		4	Political Empowerment [AFTER-BEFORE]
	Number of Units ^a		4
Rescaling Method for Covariates		Standardized	
Hidden Layer(s)	Number of Hidden Layers		1
	Number of Units in Hidden Layer 1 ^a		4
	Activation Function		Hyperbolic tangent
Output Layer	Dependent Variables	1	I have the ability to make decisions*
	Number of Units		2
	Activation Function		Softmax
	Error Function		Cross-entropy
<p>a. Excluding the bias unit Source: Output from SPSS *The dependent variable changes with the number of rounds</p>			

Table 2 gives an overview of network information. The inputs considered under covariates were pre-

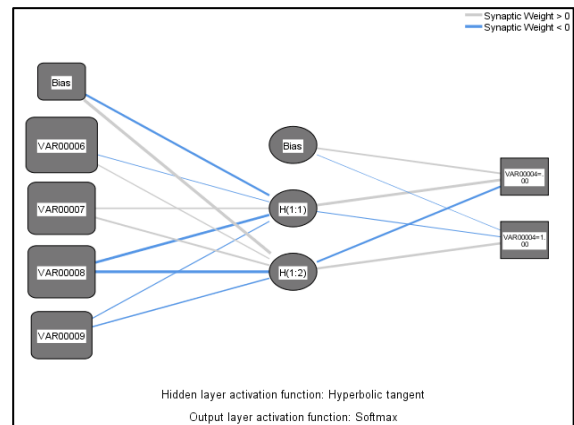
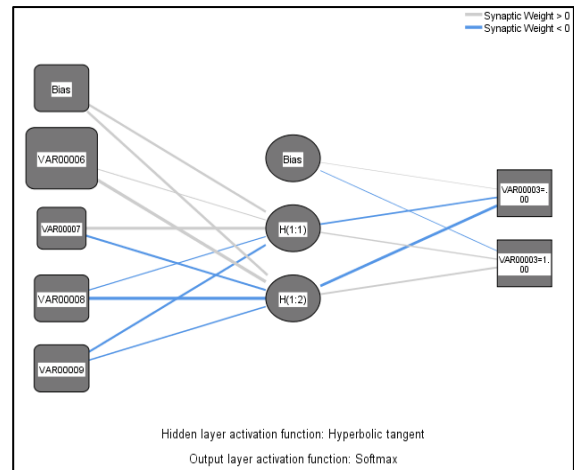
and post-psychological empowerment, educational empowerment, social empowerment, and political

empowerment ascertaining the impact of the dependent factor of empowerment. The position of the dependent variable is determined through binary questions stating the level of empowerment gained in the ability to make decisions with context to economic empowerment post joining the groups. Likewise, in round 2 the dependent variable is considered as keeping the ability to act on economic decisions, round 3 presents measuring the effect on the capacity to allocate financial resources of women after joining self-help groups, round 4 presents to measure the power of women to access economic resources after joining the group and round 5 stating the binary response of women to gain power to develop their skills after joining the groups. Taking SoftMax under hyperbolic tangent as an activation function, there is only a single hidden layer within four hidden layers.

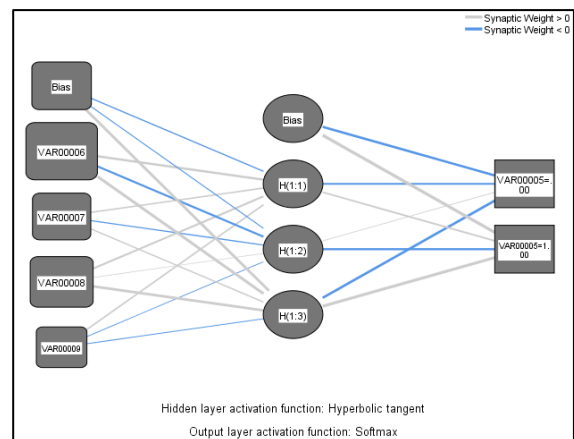
Figure 1: Rounds of ANN Model



Round 1 of ANN Model
Round 2 of ANN Model



Round 3 of ANN Model
Round 4 of ANN Model



Round 5 of ANN Model

Source: Output from SPSS and compiled by researcher

Figure 1 illustrates the feedforward structure of the neural network diagram of the ANN model. The information flowed is unidirectional and displays one hidden layer along with four neurons in it. It is considered to be the best model out of all phases.

The figure contains empowerment such as psychological (VAR0006), social (VAR0008), political (VAR0009), and educational (VAR0007) as its inputs concerning the ability to make decisions (VAR0001) economically as the output function. The neurons interconnected with each other are assigned specific weights also known as synaptic weights where the blue links represent positive weights and the grey as negative ones. The strength of the neurons can be determined with the thickness of the respective links presented graphically. The results in Figure 1 indicate a positive relationship of social empowerment with all the neurons of the hidden layer, while others consist of both negative and positive magnitude of neurons. The positive contributions of educational, social, and political empowerment strongly contribute to two neurons, one neuron respectively in round 1. The negative contribution of political empowerment is much stronger than its positive neurons of the same layer. Thus, the factors of educational and social empowerment are the most influential ones on the hidden layer. However, the individual impact on the output function remains unknown.

The neural network analysis is shown in Figure 1 of round 2 where the ability to act on decisions economically is predicted to the given covariates. It shows political empowerment (VAR009) and educational empowerment (VAR007) as the most influencing factor contributing each to two neurons respectively. Psychological empowerment (VAR006) and social empowerment (VAR008) strongly

contributes to one neuron keeping two neurons as negative contributor. Thus, political empowerment (VAR009) followed by social empowerment strongly influences to act on the economic decisions taken by women respondents involved in the groups.

The network diagram shown in figure 1 of round 3 shows the design of neural networks analysed to predict the model. Using a feed forward structure, it can be seen that social empowerment (VAR008) has the strongest effect out of all the variables taken to study the impact over the capacity to allocate financial resources of women post joining the groups.

Figure 1 of round 4 demonstrates the neural network design under feed forward structure beneath two neurons under a hidden layer. It can be seen that the factors of social empowerment are the most influencing inputs in accessing the various economic resources of women members involved in self-help groups. While educational empowerment is seen to have no impact on accessing economic resources.

Figure 1 of round 5 shows the strongest influence of psychological factors of empowerment in developing the economic skills of women involved in post joining the groups. Educational and political empowerment is seen to have positive effects on the economic skills to a lesser extent. Interestingly, the factors of social empowerment have no impact on the skills gained by women after joining the groups.

Table 3: Model Summary of the total Rounds

		Round 1	Round 2	Round 3	Round 4	Round 5
Training	Cross Entropy Error	62.378	73.984	78.952	93.961	64.939
	Percent Incorrect Predictions	18.6%	26.2%	30.4%	35.9%	19.3%
Testing	Cross Entropy Error	34.555	45.259	41.392	34.101	23.921
	Percent Incorrect Predictions	26.7%	41.4%	32.3%	29.3%	23.6%

a. Output from SPSS and Compiled by the researcher.

Table 3 gives an overview of the model summary related to the results of the training and testing datasets. Cross entropy error is used for both datasets where a smaller value of the testing dataset as compared to training sets of data

signifies no overfitting to generalize the data from the trend. The percentage of incorrect predictions according to the table is 18.6% and 26.7% which testifies to the low correctness of the model as there is a high error rate.

The model summary shown in round 2 gives an overview of the training samples that hold 26.2% of incorrect predictions with a higher value of 73.984 that indicates the low accuracy of the model been predicted. While that of testing samples holds 41.4% of incorrect predictions with a medium accuracy of 45.259 that justifies out the sample been poorly performing in analysing the results of ANN model.

Round 3 gives an overview of the model summary where the larger value (=78.9523) of cross entropy error was found in training samples when compared to testing samples (41.392). the percentage of incorrect predictions (32.3%) increased in testing samples when compared to training (30.4%). Thus,

it depicts that data has been overfitted to network and hence used for over training the samples.

Model summary of round 4 states the percent of incorrect predictions in training and testing datasets. The dependent variable shows an incorrect prediction of 35.9% which later reduced to 29.3% using cross entropy error.

The model summary of round 5 gives us a clear picture of the accuracy of the model been analysed in ANN model. The percentage of incorrect predictions increased in testing phase by 23.6% predicting a lower accuracy of the model despite of having a lower cross entropy error of 23.921 which testifies no overfitting of the data in neural networks.

Table 4: Classification of Rounds

Sample	Observed	Round 1 Predicted			Round 2 Predicted			Round 3 Predicted			Round 4 Predicted			Round 5 Predicted		
		No (0)	Yes (1)	Percent Correct	No (0)	Yes (1)	Percent Correct	No (0)	Yes (1)	Percent Correct	No (0)	Yes (1)	Percent Correct	No (0)	Yes (1)	Percent Correct
Training	0	3	25	11%	8	31	21%	35	23	60%	20	41	33%	14	22	39%
	1	1	111	99%	3	88	97%	18	59	77%	10	71	88%	6	103	95%
	Overall Percent	2.90%	97.10%	81%	8.50%	91.50%	74%	39.30%	60.70%	70%	21.10%	78.90%	64%	13.80%	86.20%	81%
Testing	0	1	16	6%	3	27	10%	15	15	50%	8	13	38%	4	9	31%
	1	0	43	100%	2	38	95%	6	29	83%	4	33	89%	4	38	91%
	Overall Percent	1.70%	98.30%	73%	7.10%	92.90%	59%	32.30%	67.70%	68%	20.70%	79.30%	71%	14.50%	85.50%	76%

Source: Output from SPSS

Table 4 of round 1 classifies the testing and training data sets based on a comparison of actual responses obtained. From a training sample of 140 rounds, 114 were correctly classified whereas, out of 60 testing samples, only 44 were correctly classified. The false positive responses are 1 sample

each for training and testing which makes it clear that there is a good possibility to predict the positive response for women who can make decisions economically.

Table 4 of round 2 displays correctly classified 96 samples out of a total of 130 samples in training and

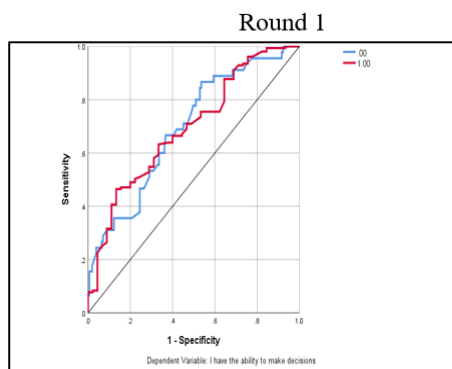
that of 41 samples out of a total of 70 samples in testing the datasets. Overall, a total of 73.8% and 58.6% were correctly classified which shows a poor response of the model showing possibility of predicting a positive response of women for having the ability to act on their own decisions.

Round 3 classifies the dependent variables by partitioning them into training and testing out the samples. As seen in the table out of a total of 135 samples, only 94 samples are correctly classified with 18 misclassified samples in training datasets. A total of 44 correctly classified samples were found with a misclassified sample of 6 responses in testing datasets consisting of 65 samples. Thus, it can be concluded that the type II error rate is of lower rate and hence the prediction of having the power to access financial resources is found to be accurate in modelling.

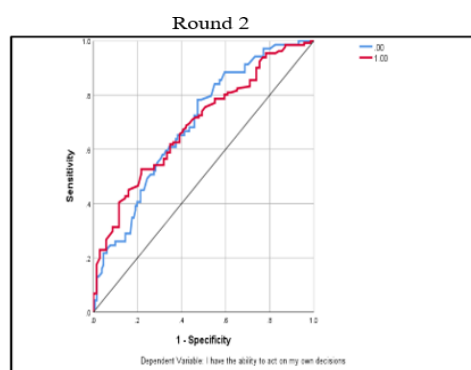
The displayed information in classification Table 4 of round 4 reveals 91 samples out of 142 samples in training datasets as true positive keeping misclassified samples to 10. While, 41 samples out of a total 58 samples are seen to be true positives keeping misclassified samples to 4.

Table 4 of round 5 displays the classification of outcome of categorical dependent variables of training and testing dataset. The network classified correctly 117 women out of 145 women in training samples, while 42 women out of 55 samples having an overall of 80.7% correctly in training and 76.4% in testing datasets. Only six women and four women are misclassified as false positive in training and testing samples respectively which makes it greater importance to predict the ability to develop economic skills in a correct manner.

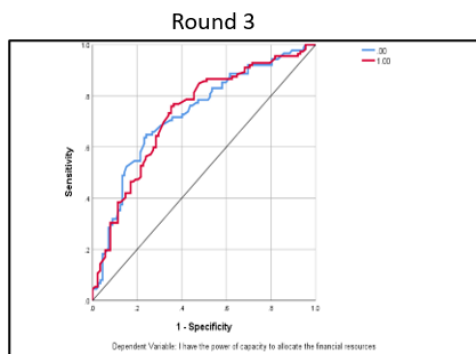
Figure 2: ROC Curve of Sensitivity and Specificity of Round 1



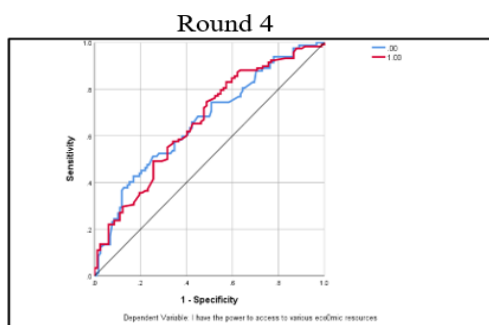
		Area
I have the ability to make decisions	.00	.694
	1.00	.694



		Area
I have the ability to act on my own decisions	.00	.692
	1.00	.692

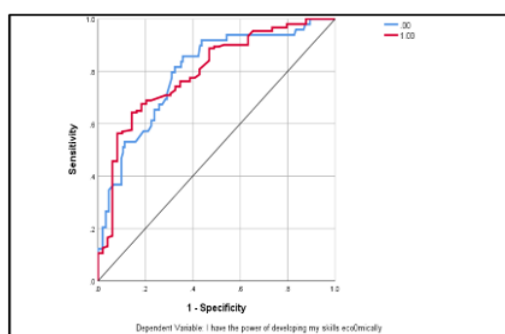


		Area
I have the power of capacity to allocate the financial resources	.00	.729
	1.00	.729



		Area
I have the power to access to various economic resources	.00	.661
	1.00	.661

Figure 5.2 ROC CURVE



		Area
I have the power of developing my skills economically	.00	.796
	1.00	.796

Source: Output from SPSS and compiled by the researcher

The figure 2 of round 1 represents the Receiver Operating Characteristic (ROC) curve. It helps us to measure the usefulness of the datasets been taken. The figure 2 as well as the Table 5 testifies the area under the curve to be performing poor (.692) in predicting a higher true positive response from the aggregate sets of given data.

Roc curve as depicted in the figure 2 of round 2 gives an overview of the sensitivity when compared to specificity of the performance of the model. The area under the curve given in table 2.5 gives a poor value of .692 of true positives against false positives

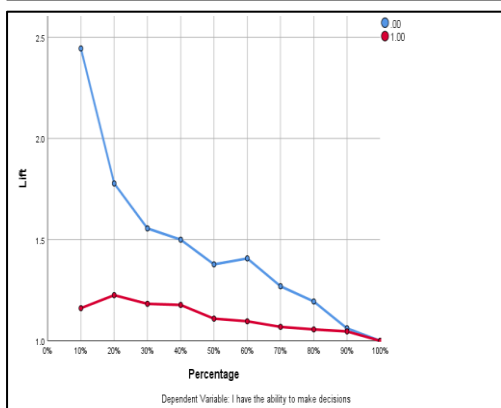
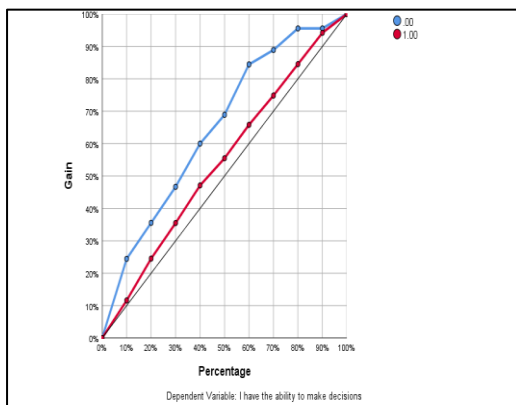
and thus have lesser contribution to predicting the dependent variable determining the ability of women to act on their own decisions after joining the groups.

Roc curve as shown in Figure 2 of round 3 shows the impact of the responses obtained from the samples under training and testing sets of data where the effect of sensitivity and specificity gives a value of .729 under the area of the curve as depicted in the table 3.5. Thus, the model shows a good performance in determining the allocation of financial resources by women of self-help groups.

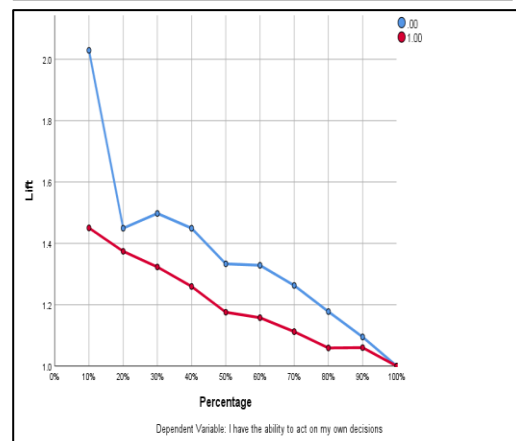
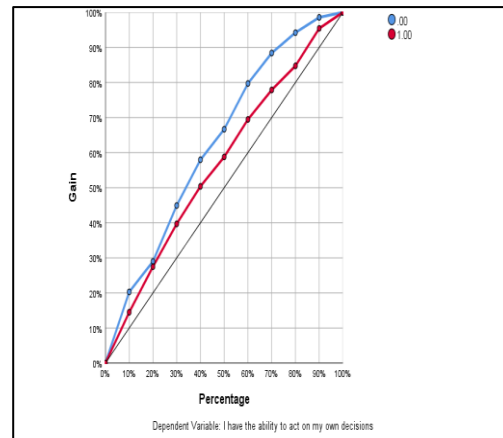
Round 4 displayed gives an over view of the area under the ROC curve of figure 4.2 where the dependent variable shows a poor score which states the low accuracy of predicting the model by using ANN.

Round 5 shows the ROC curve where binary responses were plotted to classify the performance of both the training and testing datasets. It can be seen that the plots move away from the line of 45-degree baseline which signifies the accuracy of the model been predicted through neural networks. Table 5.5 presents the area under ROC curve and it can be seen that if a woman from the no category and a woman from the yes category randomly selected then there is .796 probability that the positive response obtained from first women is higher than the response of the other followed women respectively.

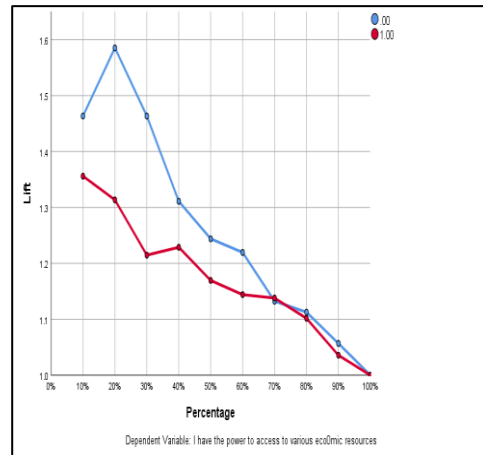
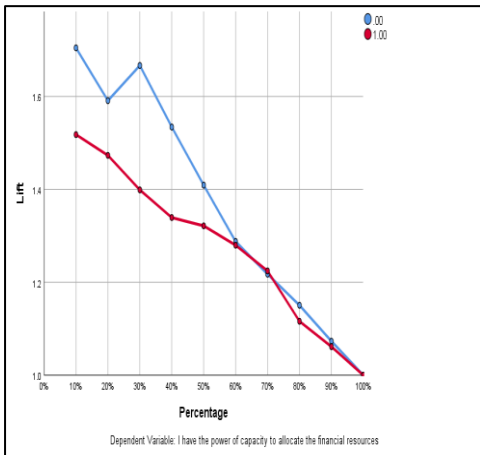
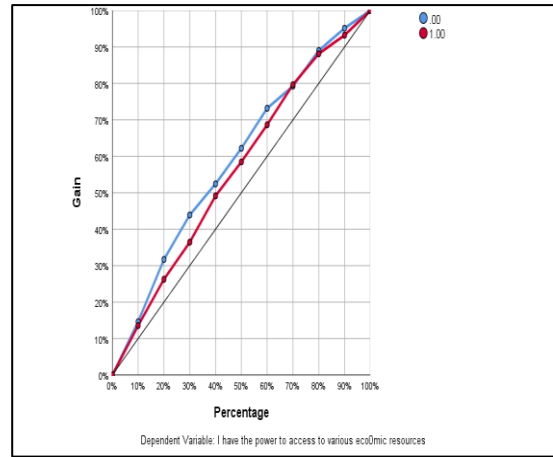
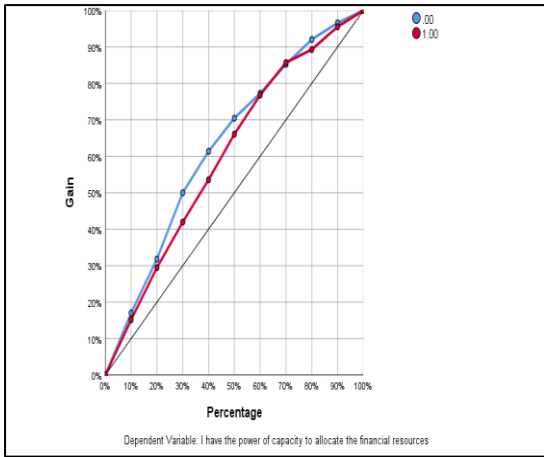
Figure3: Cumulative gain Chart and Lift Chart



Round 1

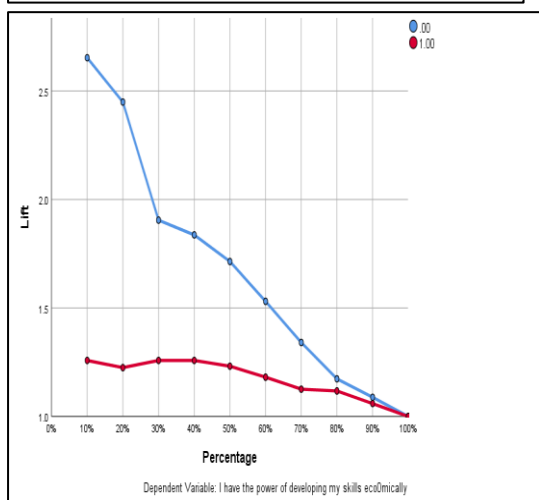
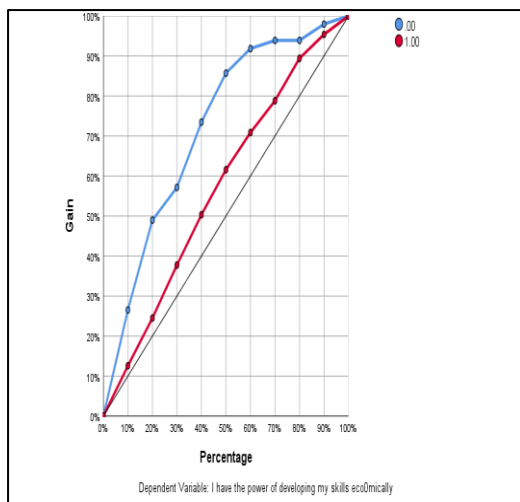


Round 2



Round 3

Round 4



Round 5

Source: Output from SPSS and compiled by the researcher

Figure 3 of round 1 gives an overview of the correctness of the model by comparing the classifications without the model. It can be seen that the points of both *yes* and *no* responses lie above the line of a 45-degree baseline which means the model can be good enough to predict the ability to make decisions. Since *no* responses are higher than the *yes* responses, it indicates a better predictability of the dependent variable over the covariates. The higher the overall responses, the higher will be the chances of predicting better. Lift charts are the visual support to evaluate the performance of the model. It predicts the benefit of modelling out the datasets in contrast to using them without a model. For example, the ninth point of the *yes* responses obtained from the samples shows a gain of 94% at an 80% level of percentage

which in turn gives the benefit of 1.175 that can be seen in the lift chart depicted in the figure given below.

Round 2 gives an overview of the results of the classification used in the model in contrast to the results used without model where the level of empowerment is found to have impact on the decisions made by the women to act upon by themselves. Here, the impact is found to be less effective as the plot points are nearer to the 45v degree baseline. Similarly, in case of lift charts, it can be seen that *yes* responses are very lower to that of *no* responses and hence the benefit of obtaining the prediction will be less effective when applied to the women in self-help groups.

Cumulative gain chart depicts the gains that can be derived by using the model in contrast to the samples without using the model. Lift chart shows the benefit of using the predictive modelling in samples. The both can be seen in Figure 3.3 where plots point at nine gained (95%.90%) in cumulative gain chart which gives benefit to the dependent sample at 1.05.

Round 3 states the cumulative gain chart as well as lift chart where the plot areas of both the binary responses are plotted after partitioning the data into training as well as testing datasets. It can be seen that the plot point of the responses isn't far away from the line which states the fact that the prediction is although correct but the prediction is far away from accuracy.

Round 4 presents an overview of the current classification of ANN model in comparison with no model been used. For instance, the fifth point on the curve of *no* category (50%, 85%) states the fact that if the network scores a dataset, it would be expected that top 50% would possess actually 85% of the samples adopting the *no* responses of the dataset. The Cumulative gain chart measures the effectiveness of the model and higher gains or nearer to the baselines a curve lies indicates better performance versus the correct predictions obtained without a model.

Lift charts are similar to model summary predicting a clearer picture of the performance of a model stating its benefits of using a model versus without

using it. Here the fifth point on the cumulative gains curve gives a lift of 1.7 for the *no* category of women to develop the skills economically.

Figure 4: Independent Variable Importance

Table 6: Independent Variable Importance										
	Round 1		Round 2		Round 3		Round 4		Round 5	
	Importance	Normalized Importance	Importance	Normalized Importance	Importance	Normalized Importance	Importance	Normalized Importance	Importance	Normalized Importance
Psychological Empowerment [After-Before]	0.249	69.20 %	0.208	52.60 %	0.427	100.00 %	0.278	100.00 %	0.451	100.00 %
Educational Empowerment [After-Before]	0.36	100.00 %	0.196	49.70 %	0.143	33.40 %	0.253	91.20 %	0.202	44.80 %
Social Empowerment [After-Before]	0.144	39.90 %	0.2	50.60 %	0.212	49.60 %	0.253	90.90 %	0.291	64.50 %
Political Empowerment [After-Before]	0.247	68.70 %	0.395	100.00 %	0.219	51.30 %	0.216	77.80 %	0.057	12.50 %

Source: Output from SPSS and Compiled by researcher

Table 6 of round 1 presents an overview of each independent variable in terms of relative and normalized importance where it depicts educational empowerment followed by psychological empowerment to be the most effective influencing factor in take decisions in the economic spheres of women indulged in various groups. Political empowerment is also found to be an important factor in taking economic decisions which is found to have greater importance than social empowerment. The same results can be seen in the figure 4 given below.

Table 6 of round 2 presents an overview of the normalized importance of the independent variables of the study. The same is also given in Figure 2.4 where it shows the sensitivity of the model in relation to the changes of the input variable. It can be noted that the variables of the political empowerment are strongly influenced by the ability to act on own decisions. Besides this, psychological empowerment also has the effects on the economic empowerment followed by social and educational empowerment.

The table given above in round 3 demonstrates the effect of independent variables in order of their normalised importance over the dependent variables. The factors of psychological empowerment are found to be the most influencing variable in determining the capacity of allocating financial resources by women of SHGs. Besides this, only political empowerment contributes more than 50% to the dependent variable. It can thus be concluded that educational and social empowerment are less effective in determining the financial resources of SHGs.

The independent variables in order of their importance are shown on Table 6 of round 4 as well as in figure. It is to be noted that the variables of psychological empowerment are the most influencing factor followed by all other variables of educational empowerment, social empowerment and political empowerment to determine to access the opportunity of having economic resources. All the variables showed a higher importance of sensitivity to impact on the decisions of having accessing the power of possessing economic resources in the group.

Table 6 of round 5 gives an overview of the independent variables and their order of importance in terms of percentage. Figure 5.4 gives a diagrammatic representation of the same which states the sensitivity of the model to change with each input variable. The table makes it apparent that variables related to psychological empowerment (100%) followed by social empowerment (64.5%) have the greatest impact on the women members to develop their skills economically. However, political empowerment is seen to be less efficient out of all domains in empowerment to influence the level of skills in women economically after joining groups.

7. DISCUSSIONS AND CONCLUSION

The paper sets out to investigate the effect of non-economic domain of empowerment on the economic factors of the women involved in various groups. Our findings revealed that the psychological urge for women to work along with the knowledge of work sense by indulging actively in the groups influenced them to showcase their skills to access and then allocate the various financial and

economic resources of the group efficiently. As the capacity of possessing decision making records the actual changes among women that occur with more of gaining empowerment, we noticed a lesser change among women to act on their own decisions of the group (Swain & Wallentin, 2012). Education paves the way to improve the well-being of women and our study found that the membership of SHGs greatly influenced their way of acquiring new knowledge and possessing it for acquiring further skills to make various decisions of the group and acquire it economically (Aggarwal et al., 2020). SHGs also known as support groups are formed to attain social change among women and have better control over their individual as well as societal lives. Our findings suggest that women's better control over their societal life and the urge to influence the direction of social changes helps them to enhance their social networks and decision-making capacity for their economic well-being of themselves including their groups which stands in line with the defining components of United Nations ICPD, 1996. The political participation of the women in the groups lets them to work for their individual as well as group's interest and making democratic decisions which in turn showed influence over the actions undertaken after making decisions and allocating resources economically. SHGs can prove to be vital cushion for economic shocks. Thus, it becomes important for policy makers to can consider stimulating the knowledge of women by providing them the gateway to access their needs accordingly. Finally, our findings reveal that benefitting women is the greatest achievement of forming SHGs where women are greatly influenced by psychological, educational, political and social domains of empowerment after joining the self-help groups.

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