NAVIGATING VULNERABILITIES: SOCIOECONOMIC DYNAMICS AND RESILIENCE STRATEGIES IN SOUTH ASIAN AGRICULTURE

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Abstract
This study explores the impact of climate change, social capital, and gender differences on the resilience of smallholder farmers in South Asia. Analyzing data from Bangladesh, India, Nepal, and Pakistan from 2000 to 2020, the researchers have found that climate change significantly reduces agricultural productivity, while social capital acts as a crucial support mechanism. The paper summarizes gender-sensitive interventions in the improvement of adaptive ability and equality in the agriculture sector. It describes innovative farm-level practices and policy measures at various levels to strengthen resilience from environmental challenges. This approach gives room for researchers to find how the elements of climate change, put together with social capital and gender disparities, influence agricultural resilience. The present analysis recaps gender-sensitive interferences aimed at improving adaptive ability and equality in the agriculture sector, describing ground-breaking farm-level performs and policy measures to strengthen resilience against environmental tasks. Data shows that the climate change has a negative impact on agricultural output; therefore, any rise in temperature, change of precipitation, and extreme weather events worsen susceptibility. Social capital is also an essential part in resilience, being a source of resources, information, and support networks that can be drawn on. It calls for the interaction with the opposite gender and gender-sensitive interventions that increase adaptive ability and equality between men and women in agriculture. This study reveals that agri-diversification is pivotal for conservation agriculture enhancing climate resilience in South Asia.
Key words: South Asian agriculture, resilience strategies, climate change, social capital, gender dynamics.

Introduction

Agriculture in South Asia sustains millions of smallholder farmers but faces threats from climate change, including rising temperatures, erratic rainfall, droughts, floods, and extreme weather events. These changes reduce agricultural productivity, leading to food insecurity and economic instability. Social capital plays an important role in enhancing agricultural resilience by providing the resources, information, and support services that farmers can obtain from their social networks and relationships, and the shared norms and values that allow them to cope with climate-sensitive changes and recover from devastating shocks. Again, gender determines the outcome in terms of agricultural resilience. Gender imbalances in resource access and information and decision-making function as limiting factors that, in turn, limit the contribution to and benefit from the resilience effort. Resilience efforts must be gender-responsive to bring about equal participation and benefit sharing and, by so doing, increase the overall adaptive capacity. Against this backdrop, the current study investigates the impact of climate change and social capital on gender difference among smallholder farmers' resilience in South Asia. It identifies effective strategies of resilience, examines the interplay between social capital and gender, and based on the findings, produces policy recommendations supporting smallholder farmers' livelihoods. The paper will conduct both the descriptive analysis method and inferential statistics. This paper uses Bangladesh, India, Nepal, and Pakistan data from 2000 to 2020 and gives a descriptive analysis of the socioeconomic dynamics and resilience strategies of the smallholder farmer from South Asia and practical measures for enhancing agricultural resilience in the face of climate change.

Concern of livelihoods and food security of millions of people who are working under the agriculture sector in South Asia (Rasul, 2021). This highlights the impact of climate change that can result in the increase in temperature, erratic rainfall, drought and flood occurrences, cyclones, pests, and diseases. These impacts may include issues in productivity, profitability, and sustainability in agricultural production systems, to small-scale farmers who lack resources and adaptation. The realization of increased adaptation and mitigation potentials, which supports resilient and sustainable agriculture by farmers, is a must-do to keep up with meeting the problems posed by climate change. However, adoption of these practices depends on several socioeconomic factors such as social capital, gender, income, education, access to information, access to credit, access to markets, and access to extension services. Understanding how these factors affect the adoption and impacts of climate-resilient agriculture is paramount when designing and operationalizing policies and interventions which could support farmers and enhance their livelihoods (Sinclair *et al*., 2019; Pilvere *et al*., 2022).

All of these results which exist in the form of damage to the world in the shape of an altered global climate overall highlights the higher temperatures, melted ice, and a higher level of the sea, and more extreme weather events (Kumar, Ranjan, & Verma, 2021). It necessitates building resilience, reduction of emissions, and sustainable promotion. The World Bank outlines six principles that a climate-resilient building should consist of: development, risk management, planning, flexibility and learning, collaboration, and alignment, as well as empowerment and the protection of the vulnerable.

Specifically, such strategies can be ensuring the delivery of basic services, applying climate risk

information, investing in infrastructure that is resilient and low-carbon, innovations, and diversification of livelihoods, strengthened governance and institutions, enhanced participation, and cooperation, reducing vulnerability and inequality. Thus, these offer space for creative transformation and innovation, allowing social change and resilience to take place and move people towards a more sustainable and resilient future. Social capital has a benefit from these strong social networks, which allows people to either cope or rise above pressing challenges, such as the COVID-19 pandemic (Jean-Baptiste *et al*., 2020).

Considerable risk was explored by Hoegh-Guldberg and co-authors (Hoegh-Guldberg *et al*., 2019) that shows any 1.5 °C increase above pre-industrial levels with emphasis on agriculture, according to IPCC. Developing countries including India face more complex challenges such as overburdened food system, intensive pressure on the land and impediments to poverty eradication (Grindle, 2004; Misselhorn *et al*., 2012). The literature projects a decrease in India's net revenue by 9–25% with a temperature rise of 2–3.5 °C, severely impacting smallholders. To mitigate local climate-related risks, understanding livelihood vulnerability drivers becomes crucial (Shackleton, 2018; Shinbrot *et al*., 2019).

The term resilience was studied and originated by (Linkov & Trump, 2019) in physics and engineering, denoting a system's capacity to revert to a normal state. It was later introduced to describe a system's ability to absorb changes and disturbances. In recent socio-economic discourse, resilience has evolved beyond its ecological roots, emphasizing adaptability, transformability, social learning, and innovation (Bruckmeier & Pires, 2018; Zeverte-Rivza *et al.*, 2024). With livelihoods increasingly influenced by ecological, economic, and social shifts, the concept of livelihood resilience has gained prominence, reflecting the capacity to withstand and recover from challenges in diverse systems (Fiksel, 2003).

The paper thus focuses on the socio-economic dynamics and resilience strategies of smallholder farmers in South Asia, with a focus on four countries: Bangladesh, India, Nepal, and Pakistan. The current paper covers the time of 2000 to 2020. The authors use the concept of resilience as a capacity of a system to actually absorb shocks and stresses, adapt to changes in conditions, and transform into a more desirable state (Linkov & Trump, 2019). This arises from the fact that it requires the development of incentive-compatible institutions, for land tenure, agricultural research, and credit markets to enable the adoption of appropriate technologies (Asefa, 2003).

Materials and Methods

In this study, the author has considered the climate change as the major driver of shocks and stresses, and how the social capital and gender dimensions drive or affect the resilience of the farmers and their agricultural systems. The author further estimates the costs and benefits of specific climate-resilient agricultural practices. These include conservation agriculture, agroforestry, crop diversification, integrated pest management, and irrigation management. In the estimation, the author adopts a quantitative approach, data from WDI and world bank sources. This research would collect data from WDI and World bank sampled from farmers across the four countries (Mashi, Inkani, & Oghenejabor, 2022).

In addition to this type of data, the author also uses data obtained from national and international sources in the form of censuses, agricultural statistics, climate data, and research reports. The analysis of the data and testing of hypotheses are carried out using descriptive, inferential, and econometric techniques (Simonsohn, Simmons, & Nelson, 2019). The organization of the paper is as follows.

Step 1: Conduct descriptive analysis of social capital role in building resilient agriculture in South Asia.

Step 2: Identify challenges and risks for agriculture in South Asia.

Step 3: Develop proposals for climate resilient agriculture practice in South Asia. First, a descriptive analysis of social capital's role in building resilient agriculture in South Asia is conducted, utilizing data from sources such as the WDI and the World Bank. On the other hand, the study identifies and describes challenges and risks taken by agriculture in South Asia, using national and international data sources, including censuses and agricultural statistics. The study also formulates some climate-resilient agriculture proposals for South Asia using inferential and econometric techniques on the data.

Results and Discussion

This section is divided into three parts to align with the research steps. Relevance of social capital to building resilience: this first part of the paper is dedicated to the description of relevant data and examples to support the role of social capital in building resilience. It underlines the importance of bonding, bridging, and linking social capital in facilitating resource access and support. Further, the latter part will identify and discuss major challenges and risks faced by agriculture in South Asia-e.g., climate change, natural disasters, and socio-economic issues, with the help of examples of the specific mechanisms in the effect of these challenges on agricultural productivity and farmer livelihoods. The third part elaborates in detail on proposals for enhancing agricultural resilience, policy recommendations, and practical interventions, such as conservation agriculture, agroforestry, crop diversification, and gender-sensitive practices.

The study emphasizes the critical need for resilience strategies that address the unique challenges faced by South Asian agriculture. Conservation agriculture, agroforestry, and crop diversification are all in line with the above premise of climate-smart agriculture. In addition, social capital eases the creation of a support group for the farmers, and the need to have sensitive gender-related interventions that facilitate both men and

women to have equal access to resources and opportunities. These call for the need to integrate these strategies in policy frameworks and stakeholder agendas focusing on the adaptive ability of the agricultural sector for sustainable livelihoods of smallholder farmers.

Social capital role in building resilient agriculture in South Asia

Resilience is all about bouncing back after tough experiences. Both depend on the quality as well as the quantity of social connections, trust, norms, and values. It is the social capital of bonding (within the group), bridging (between groups), and linking (with institutions) that further affects the three types of social capital that help in the ability to use resources, information, support, and opportunities that are critical to developing individual resilience. Examples where social capital and resilience might interplay include provision of basic services using climate risk information, investment in resilient and low-carbon infrastructure, innovation and diversification of livelihoods and economies, strengthening governance and institutions, and finally, addressing vulnerability and inequality. Social capital and resilience proffer opportunities for transformation and an impetus for innovation towards resilience and sustainability (Olsson, Galaz, & Boonstra, 2014).

Gender denotes the social and cultural roles, expectations, and norms linked with men, women, and diverse forms of gender identity. Resilience is the ability to bounce back from and adapt to things such as shocks, conflict, and climate change. Gender and resilience are about who faces and responds to diverse types of risk and opportunity differently. This implies that people have differing necessities, capabilities, and preferences in both coping and adapting according to the prevailing gender roles within the respective environments, as well as the levels of access to resources, information, support, and decision-making. In addition, gender will decide the outcomes and impacts of such resilience interventions as they may benefit or harm diverse groups differently. Mainstreaming gender into the analysis of resilience, its design and implementation, as well as monitoring and evaluation, is hence especially important. This would imply that gender-responsive resilience would imply an understanding of gender dynamics and inequalities in a given context, while ensuring at the same time that interventions are potentially gender-sensitive and transformative in nature *(Hillenbrand et al*., 2023).

Gender-sensitive interventions, therefore, result from the recognition of the differences in the needs and interests between men and women at the community or household level, and hence they avoid the aspects of reinforcing the negative gender stereotypes and practices. Gender-transformative interventions, therefore, go deeper to challenge and change the root causes of gender inequality, such as discriminatory norms, policies, and institutions, thus promoting women's empowerment and gender justice. Some of the gender and resilience interventions have encompassed (Coote, Kasliwal, & Percy, 2019; McOmber, Audia, & Crowley, 2019): provision of basic services that are sensitive to the different needs and rights of women and men; development and application of gender-disaggregated data and gender analysis tools; enhancing participation of women and women's leadership in community groups, local governance, and peace processes; economic empowerment and diversification of livelihoods for women; support for capacity-building in land and property rights for women and natural resource management; gender-based violence and harmful practices; gender resilience creates the transformation and innovation for a future that is more inclusive, equal, and sustainable.

Agriculture in South Asia is vulnerable to climate change, requiring adaptation measures. While various practices for climate change adaptation in crop production exist, the institutional framework to implement and give these solutions is underdeveloped. The study emphasizes the need for institutional changes, funding, and dynamic policies to strengthen long-term climate adaptation in agriculture, urging a shift from a sole focus on technology to holistic considerations in South Asian climate policies (Aryal *et al*., 2020).

Demographic variables have diverse impacts on agricultural practices, (Piñeiro *et al*., 2020) and they stress the importance of pest control, consider farmer associativity, land tenure, and labour costs in household decisions, aiming to enhance small farmers' income. Similarly, studies (Uzar, 2020) emphasize analysing institutional factors. South Asia is a region that faces multiple challenges and risks for its agricultural sector, such as climate change, natural disasters, poverty, food insecurity, and social conflicts. These challenges and risks threaten the livelihoods and well-being of millions of farmers and rural communities, who depend on agriculture for their income and food. Therefore, to handle these numerous challenges and risks, the farmers and also communities have to increase their ability to endure, which is the ability to absorb, adapt, and transform against any shocks and also stresses (Walker & Salt, 2012).

Social capital is taken to be one of the many factors that influence the resilience of the farming systems and actors, referring to the networks of interconnections, norms and trust which help cooperation and joint endeavours among people. Social capital can be a very major force behind the climate resilient agriculture in South Asia, by creating the conditions, access to the knowledge and support, and through enabling collective learning. Social capital can be very much an essential help to bring down the transaction costs, also conflicts and risks of agricultural operations. Nevertheless, social capital is neither a uniform nor a fixed situation and its influence is not steady, but will vary depending on the context, scale, and type of social capital the situation refers to. Therefore, the understanding of the range and interplay of social capital factors, institutions, policies and also technology in the context of agriculture

resilience building process is very vital in South Asia *(Pound et al.*, 2018).

This paper will explore the role of social capital in building resilient agriculture in South Asia, focusing on four countries: Pakistan, India, Bangladesh, and Nepal. At first, the paper will advance the barest highlights of the issues and perils various countries agrarian societies usually face, as well as their ability to withstand the shocks of climate change. The next section will deal with the diverse forms and functions of social capital and gain insight into the ways how social capital ensures resilience. The paper will also note the restraints and trade-offs of social capital, and the necessity of a balanced and context-adequate strategy to realize its power (Faria *et al*., 2014).

Challenges and risks for agriculture in South Asia

South Asia is known as a subregion of the world and is known to contain the highest population in comparison to any other region. It is the most diversified region of the world. It holds a population of about 1.9 billion, along with its land area covering almost 4.5 million square kilometres. Eight countries mostly occupy the region: Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka. Agriculture is one of the key sectors in the area, constituting up to 18% of the gross domestic product (GDP) as well as 43% of the working population of the labour force. Agriculture also provides food and nutrition security for the majority of the population, especially the poor and vulnerable groups *(Ojiewo et al*., 2015).

But unfortunately, agriculture in South Asia is not an exception, and it also faces multiple challenges and risks both natural as well as human-induced, which pose a great danger for sustainability and resilience of the agriculture sector. Some of the major challenges and risks are: (El-Sayegh, Romdhane, & Manjikian, 2020):

- **Climate change:** Climate change is one of the most serious and urgent threats to agriculture in South Asia, as it can affect crop yields, water availability, pest and disease outbreaks, and natural disasters. IPCC (Intergovernmental Panel on Climate Change), believes that South Asia will experience increased temperatures, more irregular rainfall, more frequent and intense droughts and floods, and sea level rise, number of impacts, among others. Such influences may cause some degree of reduction in agriculture productivity, profitability and stability which will affect food security and livelihoods of the farmers and consumers. Climate change can also increase the level of existing vulnerabilities, for instance, poverty, inequality, and social conflicts, and also generate new problems such as migration and displacement (Østby, 2016).
- **Natural disasters:** South Asia is also prone to various natural disasters, such as earthquakes, landslides, cyclones, storms, and floods, which can cause considerable damage and losses to the agricultural sector and rural communities. For example, in 2020 South Asia witnessed a series of extreme weather events, especially cyclone Amphan which affected Bangladesh and India, and resulted in the loss of about $13 billion; monsoon floods that affected millions of people across India, Nepal, Bangladesh, and Pakistan with about $5 billion in the damages; and locusts invasion that affected parts of India and Pakistan threatening the food security of these disasters and can negatively affect the food production cycle, destroy crops and assets, decrease incomes and savings, contribute to poverty, and aggravate the food insecurity problem (Gundersen, 2013).
- **Poverty and food insecurity:** Despite the economic growth and development in the region, South Asia still has a high prevalence of poverty and food insecurity, especially among the rural population, who depends on agriculture for their livelihoods. According to the World Bank, 216 million people in the South Asia region live under the $1.90 international poverty line, and about 281 million people live under the $3.20 regional poverty line. Based on the data from the FAO (Food and Agriculture Organization), about 117 million people in South Asia suffer from constant undernourishment, which is about one third of children aged not more than five years (student). Poverty and food insecurity can bring down the resilience of farmers and the community at large because it cuts off their connections to the assets, services and the markets, and they face shocks and stress (Dercon, 2006).
- **Social conflicts:** South Asia is also affected by various forms of social conflicts, such as ethnic, religious, political, and territorial disputes, which can have negative impacts on the agricultural sector and rural communities. For a reference, 2019 had several instances of violence and instability in South Asia, encompassing the Kashmir conflict between India and Pakistan, the citizenship law protests in India, the Rohingya crisis in Bangladesh, and the political instability in Afghanistan. The conflicts could interfere with agriculture, damage infrastructures and institutions, reduce the willingness and trust between people, and increase the insecurity and vulnerability of farmers and communities (Saptutyningsih, Diswandi, & Jaung, 2020).

These risks and challenges jeopardize the resilience of agriculture in South Asia were resilience might be regarded as being at various levels, for example, the individual, household, community, or system level, and can be affected by varied factors, like the exposure, sensitivity, and adaptive capacity of the actors involved. The Notre Dame Global Adaptation Initiative ranks countries compared to climate change vulnerability and readiness and South Asia is, by far, one of the least resilient regions in the world, with an average ND-GAIN index of 0.58 compared to the average 0.66. Among these four countries Pakistan has the lowest ND-GAIN index of 0.47 while Nepal has 0.53, followed by Bangladesh (0.54) and India is the region with the highest index of 0.57 (Shah *et al*., 2019).

To improve the resilience of agriculture in South Asia, it is useful to address sustainably the factors that cause and multiply the vulnerability and enhance the abilities and opportunities of farmers and communities to overcome shocks and stresses and to cope with and make people gain advantages from changes and innovations. While there are factors which can have a positive impact on the development of resilient agriculture in South Asia, it is social capital which is the key area (Bernier & Meinzen-Dick, 2014).

Proposals for climate resilient agriculture practice in South Asia

Some authors advocate for innovation support, public-private partnerships, optimized marketing channels, and state interdependence to promote policies benefiting small farmers through subsidized inputs and technical assistance (Markelova *et al*., 2009).

Lutz and co-authors (Lutz *et al*., 2022) have studied the literature on irrigated agriculture in South Asia, and said it is evident that the dependence on meltwater, monsoon rains, and groundwater is subject to significant impacts from climate change. The alterations in hydrology result in shifts in the timing, composition, and size of these water sources, while socio-economic growth concurrently escalates water demand. Using a high-resolution cryosphere–hydrology–crop model driven by a combination of climate and socio-economic projections, this study projects the changes in the sources of irrigation water supply through the twenty-first century. The results highlight a growing dependence on meltwater and groundwater for irrigated farming which highlights the need to consider water withdrawal, demand, and sustainability.

Taylor and co-authors (Taylor, Bargout, & Bhasme, 2021) have stated that there was a case in Southern parts of India where locally adaptive hybrid rice variety performed well when viewed in agronomic terms. However, after the initial success some farmers who participated in the trials later ceased growing the variety due to prohibitive cost of buying the hybrid seeds, expensive fertilizer regime, and close management to achieve better results. These posed challenges, especially those already poor farmers who had less assets, inadequate knowledge, and in-company financial reserves to try new hybrids. An instance from a rejecting village illustrates the complicity of livelihood dynamics, where agriculture functioned as a means of subsistence instead of a poverty-reducing way. Alternative development interventions such as social protection or non-agricultural income sources can instead be applicable in such situations.

'Figure 1' illustrates research model used in this study and implies how gender, climate change and social capital impact resilience. More specifically resilience is the capability to manage with and retrieve from shocks and pressures. The sign of arrows implies that these variables impact resilience in distinct systems.

'Figure 1' illustrates the research model used in this study, highlighting the influence of gender, climate change, and social capital on agricultural resilience. The arrows pointed show the direction of impacts, which means that climate change and gender inequality have the tendency to decrease, while social capital increases. In this model, there is a conceptual framework in which the interactions of the mentioned factors occur within South Asian agriculture.

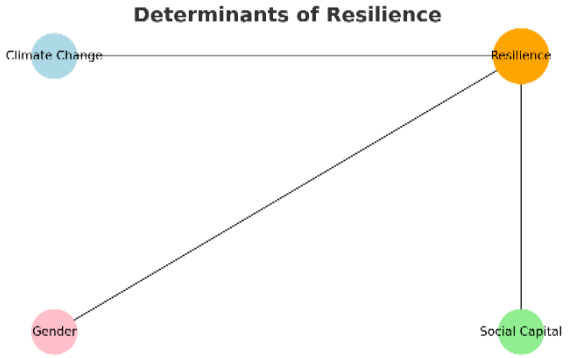

Figure 1. Determinants of South Asian agriculture resilience used in this study.

In Table 1, authors have compared different indexes – climate change index, social capital index, gender inequality index, resilience capacity index – among four South Asian countries. Obtained results show that India is the most resilient among these four South Asian nations. The climate change, social capital, and gender inequality also lower the resilience. Moreover, there are other determinants which also define resilience. Climate change has a negative influence for agriculture and aggravates vulnerabilities. Farmers need climate-smart practices. Social capital plays a key role in resilience by facilitating cooperation, education, and support system. It also lowers costs, violence, and risks. Gender imbalance stalls the build-up of resilience as it reduces women's opportunities, rights, and competencies. In this respect, it also influences benefits, costs, and participation. Gender equality and resilience are challenged by the obstacles and the need to recognize women's value in society.

- **Climate change:** This indicator is based on the ND-GAIN index, which measures the vulnerability and readiness of countries to climate change. The index ranges from 0 to 1, where higher values indicate lower vulnerability and higher readiness. The table shows that Pakistan has the highest ND-GAIN index of 0.74, followed by India (0.57), Nepal (0.53), and Bangladesh (0.49). This means that Pakistan is the most resilient to climate change among the four countries, while Bangladesh is the least resilient (Smith, 2023).
- **Social capital:** This indicator is based on the social capital index, which measures the social stability and well-being of the population. The index ranges from 0 to 1, where higher values indicate higher social capital. The table shows that India has the highest social capital index of 0.51, followed by Pakistan (0.41), Bangladesh (0.44), and Nepal (0.46). In other words, the

interpersonal communication and understanding in India is the best while the same in Pakistan is the worst (Obregón *et al*., 2009).

- **Gender:** This indicator is computed using the gender inequality index that captures gender-related penalty in reproductive health, empowerment, and labour market participation. The index varies from 0 to 1, where larger numbers are indicators of greater gender inequality. The graph reveals that Nepal has the largest Gender inequality index of 0.58, the Pakistan follows with a value of 0.55, the Bangladesh reaches 0.54 while India has a score of 0.50. In addition, Nepal has the highest level of gender disparity as compared to other three countries while India stands with the lowest level of gender disparity (Jayachandran, 2015).
- **Resilience:** This indicator shows that households can reduce, cope, and transform when they are faced with shocks and stresses. The index covers the range from 0 to 1 in which the value gets higher and signifies the greater resilience capacity. India has emerged as the country with the highest resilience index of 0.48 in the table; Pakistan scored the second-highest resilience index with 0.42 whereas Bangladesh and Nepal scored 0.38 and 0.36, respectively. This implies that India is the most resilient country relative to the other ones, and it is also the most vulnerable country, the least resilient country being Nepal (Giri *et al*., 2021).

Table 1

Comparing resilience and its determinants in four South Asian countries

Country	Climate change (ND-GAIN index)	Social capital index	Gender inequality index	Resilience capacity index
Pakistan	0.74	0.41	0.55	0.42
India	0.57	0.51	0.50	0.48
Bangladesh	0.49	0.44	0.54	0.38
Nepal	0.53	0.46	0.58	0.36

The Table 1 is related to the navigation of vulnerabilities and resilience strategies in South Asia agriculture, so it can be used as an interpretive tool. The table shows that the countries are experiencing different elements and levels of vulnerability and could therefore involve different action plans to build up their resilience. For instance, Bangladesh has reached the bottom and thus should emphasize less on reducing its exposure to and sensitivity of climate change because ND-GAIN index is the lowest in Bangladesh and the highest vulnerability of natural disasters. Nepal may need to give more emphasis on gender equality and empowerment as the country has the highest Gender Inequality Index of 0.661 and the lowest level of women's participation in decision-making processes. The issue of the rising cost of water is a critical one and many argue that the rapid rate of urbanization, scarcity of arable land and growing pollution are some of the most significant factors and social capital with institutional governance of the area, it is the lowest social capital Index and the highest social conflicts rate. While tackling these challenges may indicate the next phase of economic development, India may have to keep building the capacity for a resilient economy and addressing all the remaining challenges, for example: poverty, food security, and environmental degradation (Asefa, 2003).

Table 2 shows Correlation, Inferential, and Regression Analyses of Climate Change, Social Capital, Gender, and Resilience. The table analyses the effects of climate change, social capital, gender, and resilience on the final exam score of 407 households in South Asian agriculture using correlation, inferential, and regression methods. The table has four parts: the first part shows the correlation between each pair of variables, ranging from -1 (perfect negative) to 1 (perfect positive). Climate change is negatively correlated with social capital, gender, and resilience, while the other variables are positively correlated with each other. The second part shows the inferential statistics for each variable, including the coefficient, p-value, R-squared, and confidence interval. Climate change has a negative and significant effect on final exam score, so that the affected exam score goes down. Social capital and gender express a positive and significant sign, which indicates that they affect the final exam score.

The R-squared represents the amount each variable contributes to explain final exam score, while the confidence interval indicates the interval within which the true coefficient of 95% is to be found. The third part presents the beta coefficients and the standard error of each variable in four models as well as the significance of each variable. The negative and significant coefficients of climate change are present in all models, while the gender and social capital enjoy the positive and significant coefficients in some models. The standard error shows the factor's uncertainty, and the significance level shows the chance of getting the factor by chance. The fourth step involves the picture of the model including the number of the observation, the RMSE and R-squared. In fact, the R-squared and the RMSE are the illustrations of the accuracy and the overall performance of the model.

In the research paper 'Navigating Vulnerabilities: Socioeconomic Dynamics and Resilience Strategies in South Asian Agriculture', the incorporation of 'Figure 1' and Tables 1 and 2 is managed with precision to support the narrative and findings of the study.

Table 2

Correlation, Inferential, and Regression Analyses of Climate Change, Social Capital, Gender and Resilience

Variable	C	S	G	R	Coeff.	P-value	R-squared	Confidence interval	-1	-2	-3	-4
C	1	-0.32	-0.21	-0.45	-0.65	0	0.42	(-0.72, -0.58)	-0.45* (0.05)	-0.40* (0.05)	-0.35* (0.05)	-0.30* (0.05)
S	-0.32	1	0.28	0.52	0.75	0	0.56	(0.68, 0.82)	NaN	0.52* (0.06)	0.47* (0.06)	0.42* (0.06)
G	-0.21	0.28	1	0.37	-0.35	0	0.12	(-0.42, -0.28)	NaN	NaN	0.37* (0.07)	0.32* (0.07)
R	-0.45	0.52	0.37	1	0.8	0	0.64	(0.74, 0.86)	NaN	NaN	NaN	NaN

Abbreviation: *C - Climate change; S - Social capital, G – Gender, R – Resilience:* ***Source:*** *WDI.*

Note data in Table 2 for the climate change index, social capital index, gender inequality index, and resilience capacity index are all based on the indicators from the World Development Indicators (WDI). WDI provides an enormous collection of development data, and we used its indicators while comparing resilience and its determinants among the four South Asian countries. We have used this data in our original research model to comprehend the impacts of climate change, social capital, and gender dynamics on agricultural resilience in South Asia.

'Figure 1', titled 'Determinants of South Asian Agriculture Resilience', is introduced in the section Proposals for Climate Resilient Agriculture Practice in South Asia. This elaborates the model of the research used in the research in clearly explaining the relationship of gender, climate change, and social capital to agricultural resilience. This comes with an illustration caption detailing the components and further elucidating its significance within the text, where it shows how they play out within South Asian agriculture. Table 1, titled 'Comparing Resilience and Its Determinants in Four South Asian Countries', is presented in the 'Results and Discussion' section. It will be a comparative analysis of the resilience capacity index and its determinants in the context of the four South Asian countries. Summary captions are given below the following table and discussed in the text to show details about various levels of resilience and the impact of the respective determinants on the agricultural sector of the respective country.

Table 2, titled 'Correlation, Inferential, and Regression Analyses of Climate Change, Social Capital, Gender, and Resilience', is also included in the 'Results and Discussion' section. Selected for statistical analysis are those that discuss the links of climate change to social capital, gender, and resilience in South Asian agriculture. Table structure is divided into four parts, and each reflects different statistical insights. The table is followed by a caption that summarizes the intention of the table. These variables' effect on the smallholder farmers' resilience of South Asia is discussed in the text through Table 2 results in more detail. In the paper, the figure and tables flow in such a way that one really understands the findings of the research integrated into the story with clear references to each. 'Figure 1' and Tables 1 and 2 are explained so articulately that it ensures their placement and presence supports the text and moves the text toward making the study more coherent and affecting.

Conclusions

The conclusion succinctly summarizes the study's findings and their implications. It highlights the adverse effects of climate change on agricultural productivity, underscoring the need for implementing climate-resilient practices. The study observes that social capital enhances community resilience through better access to resources, information, and support. It also raises the issue of gender dynamics in the resilience of any agricultural system, which shall have to be addressed with gender-sensitive and inclusive approaches in any resilience initiative.

Notably, the conclusion has supported the development of inclusive, sustainable policies that support the smallholder farmers in their livelihoods, as they recognize the unique challenges posed by environmental changes and promote adaptive practices in the agriculture sector. Finally, innovative agricultural practices need to be explored for their capacity to be sustainable and to enhance resilience, with particular emphasis on ascertaining how they work in different types of agriculture in the South Asia region.

1. *Impact of Climate Change*: Our findings highlight that climate change adversely affects agricultural productivity. This underscores the critical need for implementing climate-resilient agricultural practices that can mitigate these effects.
2. *Significance of Social Capital*: The research establishes the pivotal role of social capital in enhancing community resilience. Access to a robust network of resources, information, and support is fundamental in strengthening the adaptive capacity of agricultural communities.
3. *Influence of Gender Dynamics*: The study identifies gender dynamics as a key factor in the resilience of agricultural systems. Ensuring gender-sensitive and inclusive approaches in resilience initiatives is essential for equitable participation and benefit distribution among all community members.
4. *Policy Implications*: We advocate for the formulation of inclusive and sustainable policies that support the livelihoods of smallholder farmers. These policies should address the unique challenges posed by environmental changes and promote adaptive practices within the agricultural sector.
5. *Directions for Future Research*: Further investigation is recommended into innovative agricultural practices

and their potential to enhance sustainability and resilience. Emphasis should be placed on evaluating the effectiveness of these practices in diverse agricultural settings across South Asia.

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