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RESEARCH PAPER

Cultivating prosperity: assessing the effects of fertiliser consumption, employment in agriculture, foreign direct investment, and exchange rates on value-added agriculture in SAARC nations

Raveesha Sandumini[1] · **Chamathka Kariyawasam**[1] · **Nadeena Sansika**[1] · **Tharushi Bandara**[1] · **Krishantha Wisenthige**[1] · **Ruwan Jayathilaka**[2]

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Abstract
Economic globalisation profoundly impacts most countries constituting a pivotal contributor to the national income of many nations worldwide. However, despite this, the optimisation of their modest earnings and value-added agriculture remains necessary. This study explores the influence of fertiliser consumption, employment in agriculture, foreign direct investment, and exchange rates—considered components of economic globalisation—on value-added agriculture in the South Asian Association for Regional Cooperation (SAARC) member countries. Multiple linear regression was employed to quantify the influence in eight countries from 2002 to 2021. The analysis reveals that employment in agriculture significantly impacts value-added agriculture in this sector, with the exception of the Maldives, also a SAARC member. Fertiliser consumption in Bangladesh and Sri Lanka has demonstrated a notable contribution to value-added agriculture. Foreign direct investment significantly affects the value-added agriculture of Bangladesh, Nepal, and Pakistan. Furthermore, exchange rate significantly impacts value-added agriculture, except in Bangladesh and the Maldives. This study suggests that fostering employment in the agricultural sector, promoting the utilisation of fertilisers, attracting foreign direct investment, and monitoring exchange rates can positively influence value-added agriculture in SAARC countries. Policymakers can utilise these insights to develop a conducive policy framework capable of effectively addressing the specific challenges of agriculture in their respective countries and optimising value addition in the agricultural sector. Through the implementation of these policies, SAARC countries can enhance the agricultural sector's contribution to economic growth, bolster competitiveness, and achieve sustainable development.

Keywords Agriculture value added · Economic globalisation · Fertiliser consumption · Employment in agriculture · Exchange rate · Foreign direct investment

Extended author information available on the last page of the article

Introduction

Agricultural value addition (AVA) has been significantly impacted by economic globalisation (EG), with research demonstrating both positive and negative consequences (Nugroho et al. 2021; Sansika et al. 2023). Globalisation has also improved access to markets for agricultural products, promoting increased commerce and economic expansion. This development has enabled farmers to benefit from higher crop prices and access to modern technologies and innovations that enhance improve productivity (Anderson 2010). AVA and EG reveal that a sector's net output is determined by tallying all the outcomes and deducting the intermediate inputs, followed by adjustments in agronomy, forestry, hunting, fishing, and livestock production. EG denotes a historical process arising from technological advancement and human ingenuity, facilitating this process (Di Giovanni et al. 2008; World Bank 2021).

Moreover, globalisation can enhance the quality of life in rural communities by transforming rural agriculture into a more market-oriented and value-based endeavour (Mahadevan 2003). Exchange rates (ER) and foreign direct investment (FDI) play essential roles in the global agriculture sector. Providing an income source outside primary agriculture in emerging countries is crucial in encouraging agricultural expansion and value addition (Ghazal et al. 2021). A study on the impact of EG on AVA in 17 developing nations, including India and Bangladesh, reveals that FDI and agricultural exports significantly benefit AVA in these countries, while ER has no impact (Nugroho et al. 2021). However, ER has little to no effect on the longer-term supply of value-added tea exports in Sri Lanka (Ganewatta et al. 2005).

Employment in agriculture (EA) refers to working-age employees engaged in any activity to produce agricultural goods or offer services for compensation or profit (World Bank 2021). Previous studies have shown that EA significantly affects AVA in South Asian nations, both positively and negatively (Bogodage et al. 2021; Dolan and Sorby 2003). Fertiliser consumption (FC) has boosted AVA in South Asian countries and continues to play a crucial role today. Several previous studies conducted in Nepal, India, Bangladesh, and Pakistan have confirmed that the correct type, mixture, and level of fertilisers increase agricultural productivity and output (Rajeb et al. 2017; Takeshima et al. 2017; Tewatia 2012).

This research conducts an extensive examination of how economic globalisation (EG) influences agricultural value addition (AVA) in SAARC nations, including Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka, during the period from 2002 to 2021. The aim of this study is to enhance the existing body of literature in three notable ways.

Firstly, this study independently analyses each SAARC country using data from eight countries. This approach enables better understanding of how EG affects AVA in each country. Furthermore, by considering the unique economic factors that shape each nation's development trajectory, this research provides insights into the opportunities and challenges for sustainable agricultural development in the SAARC region.

Secondly, this study employs multiple linear regression (MLR) to analyse time series data, providing a more accurate and dynamic picture of how EG affects AVA over time. By examining changes in EG and AVA over the past two decades, the research offers insights into the long-term sustainability of agricultural policies and practices in the SAARC region.

Finally, this study sheds light on various factors and time spans, aiming to enrich the existing body of knowledge by addressing gaps in the literature. It delves into the intricate interplay between economic globalisation (EG) and agricultural value addition (AVA) for SAARC countries over the period from 2002 to 2021, employing the robust methodology of multiple linear regression analysis. The findings of this investigation have the potential to offer valuable insights that could inform policy-making decisions and interventions, ultimately fostering improvements in agricultural productivity and food security within the SAARC region.

This paper is structured into seven sections, beginning with an introduction and summary of the related literature. The third section outlines the data and methodology used in the study, including dependent and independent variables for SAARC countries. The key results and discussion of the study are presented in the fourth and fifth sections, while policy implications are discussed in the sixth section. Finally, the paper concludes with a summary of the study's main findings, conclusions, and policy implications.

Literature review

Numerous prior studies have shown that EG affects AVA both negatively and positively. Several factors, including EG, primarily influence the type of AVA output produced in a nation. This literature review examines the impact of EG on AVA in the SAARC countries by analysing past studies, focusing on various variables that contribute to this relationship.

Foreign direct investments

Studies undertaken to assess how EG influences AVA through FDI are discussed in this section. FDI is a critical factor in agricultural production through technology transfer and skills that benefit farmers in the host country (Nyiwul and Koirala 2022). Furthermore, understanding the correlation between FDI and AVA can yield significant insights into optimising the advantages of FDI for the agricultural sector and, by extension, the economic growth of developing countries (Manamba Epaphra 2017). Another study found that FDI and agricultural export values have significant effects that can increase AVA in developing countries (Nugroho et al. 2021). FDI in the agriculture sector has played an essential role in modernising India's food and retail sector and meeting growing demand (Dhungana 2013).

According to scholars, FDI can boost AVA by encouraging knowledge transfer and developing talent in developing nations' agricultural sectors. They also suggest that FDI may increase the value of agricultural exports, promoting overall economic expansion. Moreover, FDI has been crucial in modernising the food and retail industries in countries like India.

Exchange rate

This section examines studies on how ER affects AVA in SAARC countries. The ER between two currencies determines how much each is worth. ER affects the inputs, and prices of agricultural commodities and, subsequently, farmers' profits. Most international agricultural transactions are conducted in US dollars (Government of Alberta 2024). According to (Nugroho et al. 2021), the ER of 17 developing countries, including India

and Bangladesh, fluctuates so much that it does not affect AVA. A study in Sri Lanka found that exchange rate changes do not significantly impact the supply of value-added tea exports (Ganewatta et al. 2005). This finding suggests that policymakers need alternative strategies to encourage tea producers to add more value to their products, such as investing in processing infrastructure or providing training and incentives for value-added production. Another study undertaken in Pakistan used both ARDL and NARDL approaches to investigate exchange rate effects on agriculture. NARDL found that adverse movements have more significant impacts than positive movements in the short and long term (Fiaz et al. 2021). Therefore, policymakers may need to use measures like currency hedging or exchange rate stabilisation funds to mitigate risks and stabilise the sector.

Although adverse movements can impact the industry more, exchange rate fluctuations may not substantially influence AVA in SAARC nations. Policymakers should consider strategies like currency hedging or exchange rate stabilisation funds to reduce risks and stabilise the industry. Additionally, other approaches like investing in processing infrastructure or offering training and incentives for value-added production may encourage manufacturers to increase the value of their products, promoting overall economic growth. More research is required to understand the precise mechanisms connecting exchange rate volatility and AVA in SAARC nations.

Employment in agriculture

As countries develop, it has been observed that the proportion of the population working in the agriculture sector decreases. While in low-income countries, more than two-thirds of the population work in agriculture, in high-income countries, less than five per cent of the population is thus engaged (Roser 2013). A study conducted in South Asia asserted that increasingly favourable agricultural business conditions ought to attract private investment in agriculture, increasing agricultural outputs and demand for rural labour. There is clear evidence of increased private agricultural investment, especially since the late 1980s; many past researchers demonstrate that EA has significant positive and negative influences on AVA in South Asian countries. However, many past findings indicate that the percentage of women working in agriculture is essential in determining the increase of AVA (Bogodage et al. 2021; Dev 2000; Dolan and Sorby 2003; Rahman 2000). A higher level of value addition in the agriculture sector may result from increased agricultural production brought on by greater employment in agriculture (Nugroho 2022).

This section emphasises how, as nations develop, the population's involvement in agriculture declines. Since the late 1980s, there has been an increase in private investment in agriculture, which has had a significant impact on AVA in South Asian nations in both positive and negative ways. AVA growth has also been significantly influenced by the proportion of women working in agriculture. According to studies, favourable agricultural business conditions should increase private investment in the sector, raising agricultural outputs and the demand for rural labour.

Fertiliser consumption

Fertilisers have been crucial in raising AVA in South Asian countries and continue to play a vital role. Many past findings in Nepal, India, Bangladesh, and Pakistan claim that suitable fertilisers boost agricultural productivity and output. Hence, the use of chemical fertilisers has become essential in raising AVA (Rajeb et al. 2017; Takeshima et al. 2017;

Tewatia 2012). Fertiliser consumption can significantly impact agriculture value addition in SAARC (South Asian Association for Regional Cooperation) countries.[1] In addition, fertilisers are vital in enhancing agricultural productivity by providing essential nutrients to crops, leading to increased yields and improved quality (FAO 2017).

According to earlier studies, fertilisers significantly contribute to rising AVA in South Asian nations. Moreover, fertiliser use can significantly affect agricultural productivity, impacting GDP and employment in SAARC nations. Therefore, the use of appropriate fertilisers has become crucial in increasing AVA. Scholars assert that fertilisers provide crops with vital nutrients, increasing yields and improving quality. Studies from Bangladesh, Pakistan, India, and Nepal support this assertion.[2]

Data and methodology

This study was reviewed and approved by the Sri Lanka Institute of Information Technology. A time series research design was employed to analyse data collected over a specific period using secondary data sourced from the World Bank. The focus of the study on investigating the impact of economic globalisation (EG) on agricultural value added (AVA) in SAARC countries, including Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka, from 2002 to 2021. To achieve the research objectives, multiple linear regression (MLR) analysis was utilised, which is a statistical technique that explores the relationship between multiple variables. The data collection process included relevant independent variables such as fertiliser consumption (FC), employment in agriculture (EA), exchange rate (ER), and foreign direct investment (FDI). These variables were selected based on their relevance to the research objectives and their availability from the World Bank.

The variable AVA was used as the dependent variable, while the other variables were treated as independent variables. The data collected on these variables were then analysed using the MLR technique to identify the impact of EG on AVA, while also controlling for the effects of other independent variables. Further details on the sources of the data and the variables are provided in Table 1, which presents information on each variable's definition, measurement, and source. The data were collected from reputable sources to ensure the reliability and validity of the findings.

All the variables that constitute the mathematical model used in this study are listed. The relationship between AVA and the selected independent variables was modelled using the following equations:

$$\mathrm{AVA}_{it} = \beta_0 + \beta_1(\mathrm{FC}_{it}) + \beta_2(\mathrm{EA}_{it}) + \beta_3(\mathrm{ER}_{it}) + \beta_4(\mathrm{FDI}_{it}) + \varepsilon_{it} \quad (1)$$

In Eq. (1), AVA_{it} represents the value of the dependent variable at time t and i counties, and ε_{it} represents the residual error term for time t. The coefficients β_0, β_1, β_2, β_3, and β_4 represent the intercept and slopes of the regression line, which describe the impact of the independent variables on the dependent variable AVAit

[1] Agriculture is a crucial sector in SAARC countries and contributes significantly to their GDP and employment.

[2] Arable land was selected as a variable of interest. However, the World Bank data did not provide information on arable land between the years 2000 to 2013. The significance of population size also an important factor to address the potential omitted variable bias and enhance the comprehensiveness of the analysis.

Table 1 Data sources and variables (2002–2021) *Source*: Compiled by authors

Variable	Definition	Measure	Source
AVA	Agriculture, forestry, and fishing, value added	(% of GDP)	The World Bank https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS
FC	Fertiliser Consumption	(Kilograms per hectare of arable land)	The World Bank https://data.worldbank.org/indicator/AG.CON.FERT.ZS
EA	Employment in Agriculture	(% of total employment) (modelled ILO estimate)	The World Bank https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS
ER	Exchange Rate	(LCU per US$, period average)	The World Bank https://data.worldbank.org/indicator/PA.NUS.FCRF
FDI	Foreign Direct Investment	(Net inflows % of GDP)	The World Bank https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS

$$AVA_t = \beta_0 + \beta_1(FC_t) + \beta_2(EA_t) + \beta_3(ER_t) + \beta_4(FDI_t) + \varepsilon_t \quad (2)$$

In Eq. (2), a mathematical model is used to describe the effect of four independent variables on the dependent variable AVA which measures the agricultural sector's contribution to the national economy. The equation considers the value of AVA at time t, represented by AVA_t, and an error term ε_t, which accounts for any unexplained variation in the data. The coefficients β_0, β_1, β_2, β_3, and β_4 represent the intercept and slopes of the regression line.

The analysis also addressed missing data. Specifically, the missing values in the AVA variable for the Maldives in 2002 and the FC variable for all SAARC countries in 2021, as well as the missing values in the EA variable for all SAARC countries in 2020 and 2021, were interpolated using Stata's "ipolate" and "epolate" functions. These functions estimate missing values based on nearby data points to provide an informed estimate of the missing value.

Finally, it is noted that there were no missing values in the FDI or ER variables, indicating that all data points for these variables were present and accounted for.

Results

This study assessed the impact of EG on AVA in SAARC countries, compassing eight South Asian nations. Figure 1 (generated using Tableau) illustrates the geographical distribution and average AVA values over 21 years. Notably, Nepal had the highest average AVA, whereas Maldives had the lowest, with a significant disparity of 23.14. Afghanistan followed Nepal in AVA, and Bhutan slightly outperformed Bangladesh by 1.13. Sri Lanka recorded an average AVA value of 9.90.

The descriptive statistics of five key variables (AVA, FC, EA, ER, FDI) are summarised in Table 2. The analysis includes 160 observations from 2002 to 2021, with 20 observations per SAARC country.

Nepal showed the highest mean AVA (28.91), and Maldives the lowest (5.76). In terms of FC, Afghanistan had the lowest mean (6.39), while Bangladesh led with the highest (246.0), followed closely by Sri Lanka (242.42). For EA, Nepal again led (68.94), with Maldives at the lower end (12.53). Sri Lanka had the highest ER at 130.10, and Maldives the lowest at 14.17. FDI varied significantly, with Maldives having the highest mean (8.36) and Nepal the lowest (0.26).

Furthermore, SD measures the variability or spread of the data from the mean, with a larger SD indicating more variability. According to the results, SD varies across the countries and variables. For example, SD for FDI is generally low for all countries, indicating relatively low variability in this variable. On the other hand, the SD for FC is usually higher.

Finally, these findings suggest that SAARC countries have distinct economic profiles and experience varying levels of economic development. The variations in economic indicators could be due to differences in natural resources, economic policies, and governance systems, among other factors. Policymakers and stakeholders in these countries can use these findings to identify their countries' strengths and weaknesses and devise appropriate policies to address their economic challenges.

Figure 2 presents scatter plots showing the fitted values for FC, EA, ER, and FDI across the SAARC countries from 2002 to 2021. The green dots indicate observed values, with outliers and regression lines shown within a 95% confidence interval.

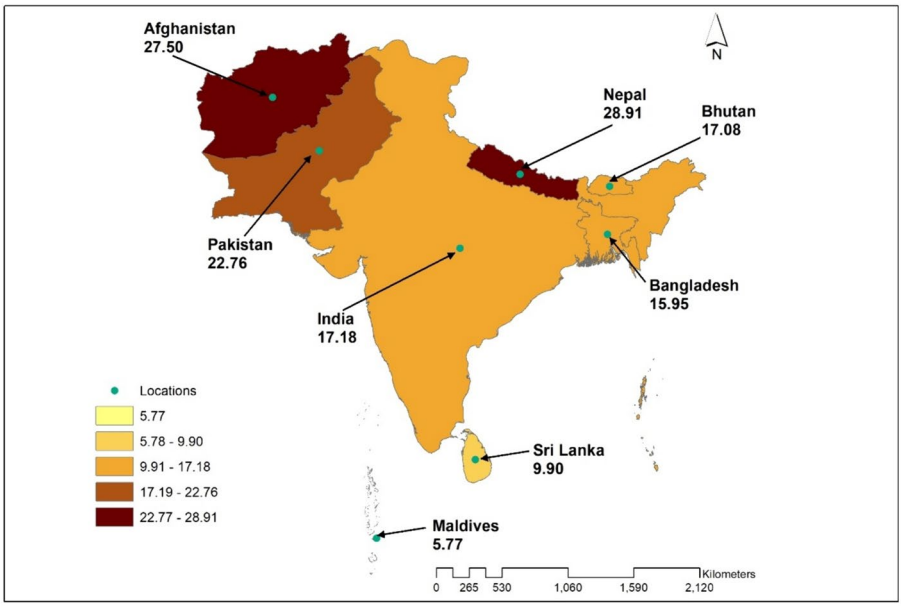

Fig. 1 Average values of AVA for SAARC Countries. *Source*: Author's creation based on boundaries provided by the Survey of India (2024)

These findings have important implications for policymakers and stakeholders in the SAARC countries. By identifying the trends in these economic indicators, they can devise appropriate policies and strategies to address their countries' financial challenges and promote economic growth and development. Additionally, this analysis can help identify the best practices of prosperous nations in these variables and adopt them in other countries for similar economic growth.

The panel data regression results, summarised in Table 3, indicate that only EA was statistically significant. The models employed include fixed effects (FE) and random effects (RE), with the coefficient estimates showing the effect of unit changes in independent variables on AVA.

The standard error means the variation in the coefficient estimate due to chance. In interpreting the table, it is essential to note that the significance of the coefficient estimates depends on the p value associated with each coefficient. The *p* value indicates the probability of obtaining a coefficient as extreme as the one observed in the sample if the actual coefficient is zero. For example, a *p* value of less than 0.01, 0.05, 0.1 indicates that the coefficient estimate is statistically significant at the 1%, 5%, and 10% levels and that can reject the null hypothesis that the actual coefficient is zero. The F value tests the overall significance of a regression model. And also text the differences in group means in ANOVA. Durbin–Watson statistic, which is a measure used in regression analysis to detect autocorrelation in the residuals (errors) of a statistical model. It ranges from 0 to 4, and values around 2 suggest no significant autocorrelation, while values significantly different from 2 indicate the presence of autocorrelation.

The MLR results in Table 4 present the impact of EG on AVA in SAARC countries. In Afghanistan, FC has a negative coefficient, indicating that an increase in FC is associated with a decrease in AVA. However, this coefficient is not statistically significant at

Table 2 Descriptive statistic for South Asia Countries *Source*: Authors' calculation based on data from the world bank

Countries		Variables				
		AVA	FC	EA	ER	FDI
Afghanistan	Obs	20	20	20	20	20
	Mean	27.50113	6.397836	52.726	57.50669	1.080803
	SD	4.893328	5.061035	8.21189	11.2558	1.273452
	Min	20.63432	1.77786	41.24	46.45246	0.0643889
	Max	38.62789	20.45253	64.42	77.73795	4.352575
Bangladesh	Obs	20	20	20	20	20
	Mean	15.94512	246.0061	46.0165	73.573	0.8807268
	SD	2.782817	57.73296	6.314542	9.014947	0.4340345
	Min	11.63286	160.2669	36.12	57.888	0.0955794
	Max	20.58413	325.8039	59.9	85.08376	1.735419
Bhutan	Obs	20	20	20	20	20
	Mean	17.07867	12.3801	59.506	55.59772	1.150156
	SD	2.984799	4.514534	3.384615	11.36862	1.649614
	Min	13.96398	6.942308	55.1	41.34853	-0.675563
	Max	23.20139	23.96	65.3	74.09957	6.321598
India	Obs	20	20	20	20	20
	Mean	17.17827	160.1623	49.36	55.59666	1.730501
	SD	0.9658713	32.68549	5.817281	11.36681	0.6978698
	Min	16.03163	100.3291	41.13999	41.34853	0.6058893
	Max	19.592	232.3603	58.6	74.09957	3.620522
Maldives	Obs	20	20	20	20	20
	Mean	5.767525	76.55859	12.534	14.17813	8.363178
	SD	0.8813878	51.52002	3.629168	1.290119	3.774624
	Min	4.603988	6	7.74	12.8	2.755601
	Max	8.004879	193.5231	18.5	15.39084	17.13262
	Obs	20	20	20	20	20
	Mean	28.91081	43.83422	68.9465	89.0516	0.2657441
Nepal	SD	4.826279	37.68897	3.46911	17.9304	0.2310492
	Min	21.31989	1.364865	62.97999	66.41503	-0.0983749
	Max	36.1503	116.6796	74.19	118.3452	0.6774399
	Obs	20	20	20	20	20
	Mean	22.76302	132.4045	41.467	94.28194	1.199847
Pakistan	SD	1.020893	17.97878	2.668107	33.82545	0.9806796
	Min	20.67787	97.78475	35.92	57.752	0.3828265
	Max	25.12918	157.9165	44.7	162.9063	3.668323
	Obs	20	20	20	20	20
	Mean	9.903575	242.4209	31.4045	130.1005	1.193066
Sri Lanka	SD	2.415107	71.85458	5.1809	31.16454	0.3844571
	Min	7.256247	117.3936	23.94	95.66206	0.5083467
	Max	14.27932	406.3321	40	198.7643	1.863973

Obs., Mean, SD, Min. and Max. represent observations, standard deviation, minimum and maximum, respectively

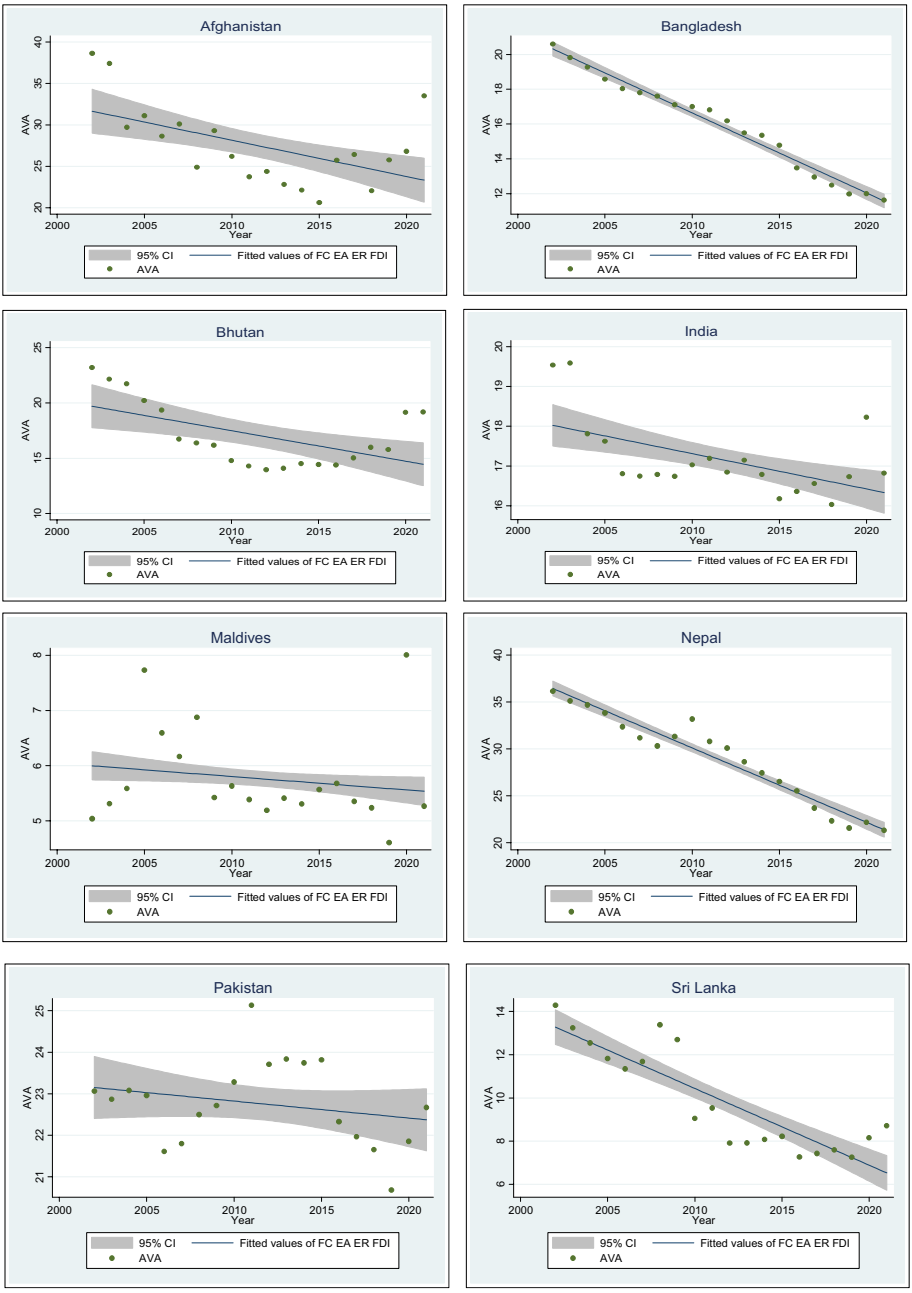

Fig. 2 Scatter plots for dependent variable in SAARC Countries

any conventional significance level. EA and ER have a positive and statistically significant effect on AVA in Afghanistan. In Bangladesh, ER is the only variable that is not statistically significant. The other variables, FC, EA, and FDI, are statistically significant.

Table 3 Panel regression results *Source*: Authors' calculation based on data from the World Bank

Variables	AVA	
	FE	RE
FC	−0.00284	−0.003297
EA	0.3592385***	0.3615066***
ER	−0.0004533	0.000514
FDI	0.0231216	0.0232054
Constant	2.190346	2.071224
Observations	160	160
No. of years	20	20
R^2 within	0.3988	0.3987
R^2 Between	0.6880	0.6898
R^2 Overall	0.6497	0.6512

*Significant at 10%, ** significant at 5%, and ***significant 1% significance level; FE denotes the Fixed effect model and RE denotes random effect model

Furthermore, an increase in EA is associated with an increase in AVA, and an increase in the ER is also associated with an increase in AVA. But the increase in FC is associated with a decrease in AVA. In Bhutan, EA and ER are positively significant at the 1% level. In India, EA and ER are statistically significant at the 1% and 5% level. An increase in EA and ER are associated with an increase in AVA. In Maldives, none of the independent variables are statistically significant at any conventional level of significance. However, in Nepal, all the variables are significant effect on AVA. In Pakistan, EA and FDI significant at the 1% level. An increase in EA is associated with an increase in AVA, and an increase in the FDI is associated with a decrease in AVA. ER has a positive and statistically significant effect on AVA at the 1% level. In Sri Lanka, EA and ER are statistically significant at the 1% and 10% level. An increase in EA and ER is associated with an increase in AVA. FDI is negatively significant at the 1% level in Sri Lanka.

The R-squared values indicate the proportion of variance in AVA explained by the model, ranging from 0.1236 to 0.9797, with higher values suggesting a better model fit. The F values confirm the model's significance in all countries except Maldives. The Durbin–Watson statistic suggests no significant autocorrelation in Bangladesh, India, Maldives, Nepal, and Pakistan, while Afghanistan, Bhutan, and Sri Lanka exhibit signs of autocorrelation.

Discussion

Agriculture hols significant potential for contributing to Afghanistan's economic growth, with a projected 7.5% increase by 2024. It employs 45% of the workforce and 22.8% of self-employed individuals and family businesses (Attal 2021). However, the current study finds that FC is insignificant concerning AVA, while EA and ER show positive and

Table 4 MLR model results for South Asian countries *Source*: Authors' calculation based on data from the World Bank

Variables	Afghanistan AVA	Bangladesh AVA	Bhutan AVA	India AVA	Maldives AVA	Nepal AVA	Pakistan AVA	Sri Lanka AVA
FC	−0.0683862	−0.0220137***	−0.0999673	0.0098566	−0.001972	0.0779865**	−0.0168048	0.0084255**
	(.2540364)	(0.0047102)	(0.0609011)	(0.0091569)	(0.0036107)	(0.03482)	(0.010621)	(0.0032391)
EA	1.116679***	0.3044572***	1.436848***	0.3071219***	−0.1306081	1.836714***	0.4575733***	0.5034003***
	(.3121426)	(0.0336425)	(0.1615178)	(0.1038559)	(0.148711)	(0.1939111)	(0.1151445)	(0.0889136)
ER	0.5713991***	0.0406485	0.3258371***	0.0972634**	−0.4394883	−0.102046*	0.0208431*	0.0260531*
	(0.1619719)	(0.0313764)	(0.076833)	(0.0452597)	(0.2892196)	(0.0560251)	(0.009853)	(0.0148671)
FDI	−1.157361	0.5035531**	0.036958	−0.3462324	−0.0265401	3.495539**	−0.6797446***	0.5715101
	(0.9961337)	(0.2255491)	(0.1231259)	(0.2192266)	(0.0572102)	(1.327205)	(0.1336281)	(0.7000757)
Constant	−62.54778	3.916436	−85.34309	−4.368282	14.00862	−92.98421	4.86432	−12.01935
Observation	20	20	20	20	20	20	20	20
No. of years	20	20	20	20	20	20	20	20
F value (witst	12.29***	287.53***	73.56***	5.98***	1.37	238.81***	9.52***	84.44***
DW Stat	1.495773	1.83298	0.8598496	1.66548	2.173369	2.013993	2.171253	1.185051
R^2 Squared	0.6204	0.9797	0.7895	0.6336	0.1236	0.9748	0.6715	0.8835

The symbols *, **, and *** represents 10%, 5%, and 1% significance level, respectively

Parentheses represent the robust standard error

statistically significant effect. With agriculture serving as the bedrock of Afghan livelihoods, the sector's significance cannot be overstated in the country's economy.[3] The past study shows agriculture contributes to at least 25% of the GDP and sustains 80% of all means of livelihood (FAO 2024).

In Bangladesh, only ER is not statistically significant, while FC, EA, and FDI are statistically significant. Increasing EA and ER both enhance AVA but increasing FC decrease it. A previous study shows that increased extension contact reduces chemical fertiliser use, leading to higher profits and yields (Rahman and Connor 2022).

Bhutan's agricultural sector has potential for diversification, but poor and marginalised farmers face challenges such as limited infrastructure, information, credit, and technological knowledge. These challenges limit diversification and hinder economic growth. Present studies show that EA significantly impacts AVA in Bhutan. Investment in agriculture and creating employment opportunities could increase value addition, leading to higher incomes and improved livelihoods (Tobgay 2006). The present study ads ER significantly positive at a one per cent level.

In India, nearly 70% of the population depends on agriculture, significantly contributing to the economy (Kumar and Raghavendra 2019). The present study underscores the significance of EA, revealing its substantial impact on AVA. This highlights the need for prioritising investments in the agriculture sector to enhance productivity and increase the sector's economic contribution. The study also shows that ER significantly impacts AVA, although past studies highlight challenges due to discriminatory trade policies and overvalued exchange rates. Policymakers should address these challenges by implementing effective trade policies that prioritise local farmers (Pardeep 2011).

In the Maldives, agriculture is vital for food security, but the present study shows no statistically significant impact of the independent variables on AVA. However, past studies emphasise the importance of agricultural policies promoting sustainable farming through farmer training. The Maldives must prioritise value-added agricultural policies to improve sector performance and ensure a sustainable future (Shafeeqa and Abeyrathne 2022).

In Nepal, previous studies highlight the importance of physical capital, such as fertiliser and farm equipment, in promoting AVA. However, the present study reveals that all independent variables, including EA, ER, FC, and FDI, statistically impact AVA. Policymakers should consider these factors to ensure sustainable agricultural practices and boost economic growth. By investing in appropriate resources and policies, Nepal can develop its agricultural sector and leverage its potential for the people's benefit (Tuladhar et al. 2014).

The study further reveals that employment in agriculture significantly impacts AVA in Pakistan. Past studies emphasise the agriculture sector's role as a significant source of employment and GDP, mainly based on crops like wheat, rice, and sugarcane (Shafique 2017). Both studies highlight the need for policies that create skilled workforces for value addition and crop diversification to promote sustainable agricultural growth. Past studies also examined trade openness and FDI's impact on agriculture, finding a positive association with AVA but a negative one with gross fixed capital formation. The present study finds FDI statistically significant for AVA in Pakistan, underscoring its importance in promoting sustainable agriculture and economic growth (Rasheed et al. 2021).

Both past and present studies highlight the significance of employment in Sri Lanka's agriculture sector, which accounts for nearly a quarter of total employment. The present study underscores the importance of EA in enhancing AVA, indicating the need for

[3] The previous study indicates that agriculture contributes to at least 25 per cent of the GDP and sustains 80 per cent of all livelihood (FAO 2024).

sustainable practices to create jobs and boost the sector's economic contribution (Trade Economics 2023). Additionally, the impact of ER is significant, influencing agriculture exports and economic growth while affecting local food production and small-scale farmers. These findings offer valuable insights for Sri Lankan policymakers on balancing the advantages and drawbacks of ER reforms in the agriculture sector (Yamaguchi and Sanker 2006). The study also notes a significant positive impact of FC on AVA.

Conclusion and policy implications

This study determined the impact of FC, EA, ER, and FDI on AVA in SAARC countries using MLR analysis over 20 years (2002–2021). The analysis of the impact of EG factors on AVA in SAARC countries reveals some unique insights. Afghanistan, Bhutan, and India benefit from investing in EA and ER to increase AVA. In contrast, Bangladesh should be cautious about FC as it harms AVA. However, they could leverage EA and FDI to enhance AVA. The findings suggest that Nepal should focus on all independent variables to increase AVA. Pakistan can capitalise on EA and ER to enhance AVA while being careful about FDI, which has a negative impact. Finally, Sri Lanka should invest in FC, EA, and ER to increase AVA.

Overall, it is recommended that policymakers in these SAARC countries utilise these insights to guide their investment and policy decisions, which could positively impact value addition in agriculture. Furthermore, future research could explore the impact of additional factors, such as technology, infrastructure, and government policies, on agriculture value addition in these countries. Another limitation of our study is the exclusion of certain critical variables, including population size and the percentage of cultivable land to total land. This omission may introduce a significant omitted variable bias into our model, potentially leading to biased estimates. Subsequent research in this area should aim to incorporate these variables to enhance the robustness and comprehensiveness of the analysis. The main findings of the research suggest that countries can implement several policies to enhance their value-added agriculture. One such policy is to encourage employment in the agricultural sector, as it has been found to significantly impact value-added agriculture in all SAARC member countries except for the Maldives. Promoting the use of fertilisers can be another effective policy, as it has been found to contribute significantly to value-added agriculture in Bangladesh and Sri Lanka. In addition, attracting foreign direct investment can benefit countries such as Bangladesh, Nepal, and Pakistan, as it has been found to impact their value-added agriculture substantially. On the other hand, monitoring exchange rates can be a critical policy for most countries, as it has been found to significantly affect value-added agriculture, except for Bangladesh and the Maldives.

Finally, this study highlights the importance of considering different economic factors to enhance value addition in agriculture in SAARC countries. The findings offer valuable insights for policymakers and stakeholders to make informed decisions that can positively impact the agricultural sector. However, it is essential to acknowledge the study's limitations, such as the use of a specific model and the exclusion of other relevant variables. Therefore, future research can build on this study by employing different models and including additional variables to provide a more comprehensive understanding of the factors influencing value addition in agriculture. By doing so, policymakers and stakeholders can continue to make informed decisions that lead to sustainable and inclusive economic growth in the agricultural sector.

Policy implication

Based on the finding that EA has a significant positive impact on AVA in SAARC countries, policymakers and governments in these countries can consider several policy recommendations. First, to increase the quality and quantity of agricultural products, investment in the agricultural sector can be increased by providing incentives to farmers and agribusinesses. Second, governments can enhance access to credit for farmers, establish dedicated financial institutions and facilitate microfinance institutions to provide small loans to those who cannot access traditional credit facilities. Third, improving infrastructure in rural areas—such as roads, electricity, and water supply, can facilitate the transportation of agricultural products and improve access to inputs. Fourth, investment in agricultural research and development can improve crop varieties, soil fertility, and pest control, leading to higher yields and better-quality products. Strengthening market linkages between farmers and buyers domestically and internationally through the establishment of market information systems, value chains, and contract farming is also essential. Focusing on smallholder farmers, who constitute the majority of the farming population in SAARC countries, by designing policies that improve their access to inputs, credit, and markets and promoting their participation in value chains is crucial. Finally, governments should encourage sustainable agriculture practices that promote environmental conservation and provide long-term benefits for the agricultural sector and the environment. Overall, implementing these policy recommendations can enhance the positive impact of EA on AVA in SAARC countries.

The impact of FC on agriculture value added in SAARC countries differs based on the country. Therefore, policymakers and governments in these countries can consider implementing specific policy recommendations to enhance their agriculture sectors. For Sri Lanka and Nepal, promoting the balanced use of fertilisers, improving access to credit, and providing technical support to farmers are recommended. This can help improve soil fertility and reduce the negative impact of chemical fertilisers on the environment. Additionally, providing easy access to credit and technical support can help farmers select appropriate crop fertilisers. In Bangladesh, reducing the overuse of fertilisers, improving soil testing services, and promoting crop diversification are recommended. This can help to promote the judicious use of fertilisers, determine the appropriate amount and type of fertilisers needed for crops, and reduce the overdependence on crops that require large amounts of fertilisers. By implementing these policy recommendations, the negative impact of FC on agriculture value added in Bangladesh can be minimised, while the positive impact in Sri Lanka and Nepal can be enhanced.

The ER has been found to positively impact AVA in SAARC countries such as Afghanistan, Bhutan, India, Pakistan, and Sri Lanka. In contrast, it has a significant negative impact on Nepal. Therefore, policymakers and governments in these countries can implement specific policy recommendations to enhance their agriculture sectors. For Afghanistan, Bhutan, India, Pakistan, and Sri Lanka, providing easy access to export financing and credit for agricultural producers and exporters to expand their international market reach help support to increase AVA. In Nepal, developing and promoting financial instruments such as forward contracts and options, which allow agricultural producers to hedge against adverse currency movements, is recommended to mitigate the negative impact of ER on AVA. By implementing these policy recommendations, policymakers and governments in these SAARC countries can help to boost their agriculture sectors and ultimately contribute to their economic growth.

Based on the finding that FDI has a significant positive impact on AVA in SAARC countries such as Bangladesh and Nepal, and a significant negative impact on Pakistan, the following policy recommendations can be made to policymakers and governments in these countries. For Bangladesh and Nepal, policies should be aimed at attracting FDI in the agricultural sector. This can be done by incentivising foreign investors, simplifying regulations, and ensuring a favourable business climate. Governments can also work to improve infrastructure and access to credit to facilitate investment in the agricultural sector. In Pakistan, policies should be aimed at identifying the reasons for the negative impact of FDI on AVA. Governments can examine whether there are any regulatory barriers or institutional constraints preventing foreign investors from positively impacting the agriculture sector. Once the barriers are identified, governments can work to remove them and create a more favourable environment for foreign investors. The government should establish research and development centres in collaboration with FDI firms to promote innovation and technology transfer in agriculture, improving productivity and value addition.

In conclusion, tailored policies for each SAARC country can strengthen their agricultural sectors, contributing to economic growth and improved livelihoods. Future research should adopt different models and incorporate additional variables for a more comprehensive understanding of factors influencing AVA.

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Authors and Affiliations

Raveesha Sandumini[1] · Chamathka Kariyawasam[1] · Nadeena Sansika[1] · Tharushi Bandara[1] · Krishantha Wisenthige[1] · Ruwan Jayathilaka[2]

✉ Ruwan Jayathilaka
ruwan.j@sliit.lk
https://www.sliit.lk/faculty-of-business/staff/ruwan.j/

Raveesha Sandumini
rsandumini@gmail.com

Chamathka Kariyawasam
chamathkah19@gmail.com

Nadeena Sansika
nadeenasansika@gmail.com

Tharushi Bandara
Tharudewmi67@gmail.com

Krishantha Wisenthige
krishantha.w@sliit.lk
https://www.sliit.lk/faculty-of-business/staff/krishantha.w/

[1] SLIIT Business School, Sri Lanka Institute of Information Technology, New Kandy Road, Malabe, Sri Lanka

[2] Department of Information Management, SLIIT Business School, Sri Lanka Institute of Information Technology, New Kandy Road, Malabe, Sri Lanka