Original Research Article

Analysis of Socio-economic Impacts of COVID-19 on Agricultural Practices in Chikkaballapur District using Stepwise Regression

Abstract

The COVID-19 pandemic has profoundly impacted rural farming communities, revealing significant shift in economic factors, production methods, and farm management practices. This study, conducted in Chikkaballapur district, Karnataka, delves into the socio-economic ramifications of the pandemic on agricultural practices and the livelihoods of farmers. Utilizing a stepwise regression analysis approach, the research identifies influential variables such as changes in farm management, production, and health and sanitation facilities. Data were collected from 50 respondents during the pandemic's peak, employing statistical measures like mean, standard deviation, and coefficient of variation for comprehensive analysis. The findings underscore the intricate relationships between various factors affecting rural livelihoods and highlight the need for targeted interventions and policy measures. The study emphasizes the importance of resilience, innovation, and adaptive strategies to support farmers in navigating the challenges posed by the pandemic and sustaining the agricultural sector amidst global uncertainties.

Key Words: COVID-19, Agricultural practices, Socioeconomic impact, Stepwise regression analysis, Farm management

Introduction

Farmers play a crucial role in society by providing the food we eat, making them vital to civilization. As India's population grows and farmland decreases, the importance of farmers increases. Without them, even white-collar jobs would struggle due to a lack of food supply. Known as the 'Backbone of India,' farmers work tirelessly, facing various challenges like climate change and natural disasters, yet they persist and make significant contributions to society [1]. Agricultural extension services are essential for spreading knowledge and skills within the farming community [2][3] emphasizes that these services aim to change farmers' behaviours, empowering them to participate actively in agricultural programs and boost farm productivity.

The COVID-19 pandemic affected people differently depending on their roles in society [4]. While some could switch to remote work, farmers had to continue working in the fields, exposing them to the virus [5]. The pandemic disrupted food supply chains, impacting both production and demand [6]. Grocery demand soared, causing shortages, while some farmers faced surplus production due to reduced foodservice demand [7]. Despite the increased risks, essential workers in

agriculture and food industries, including farmers, continued their critical work [8].

In India, the pandemic's economic impact has been particularly harsh due to existing issues such as unemployment, low wages, and various unorganized sectors. This vulnerability has affected agriculture, with disruptions in labour, transportation, and misinformation impacting harvesting and sales. Poultry farmers, for instance, dealt with misinformation about COVID-19 spreading through chickens [9]. While media reports offer some information, there is a lack of systematic data on the pandemic's effects on farmers.

This study aims to analyse the socioeconomic conditions before and after the COVID-19 pandemic. It will explore how farmers adapt to factors like agricultural technology, market changes, farm management techniques, healthcare access, and migration trends. The study also seeks to predict these adaptations in terms of scores related to socioeconomic and environmental variables.

Methodology

The study was carried out in Chikkaballapur district of southern Karnataka during the 2020-21 period, focusing on the socioeconomic impact of the COVID-19 pandemic on rural lifestyles. Adopting an ex-post-facto descriptive research design, the study aimed to understand the current perceptions, challenges, and practices prevalent in the rural communities during the pandemic to draw valid conclusions. As described by Ray and Mondal [10], ex-post-facto research seeks to determine the reasons behind an event after it has already occurred. This design was deemed appropriate due to its alignment with the study's objectives, variables, sample size, and the phenomenon under investigation.

In the study, the independent variables (X1-X11) encompass various factors related to the farmers' demographics, farming practices, and resource availability. These include age (X1), education (X2), family size (X3), farm size (X4), income (X5), number of farm vehicles (X6), number of farm animals (X7), water resource availability (X8) classified as Rainfed or Borewell, major crops grown (X9), health and sanitation facilities (X10), and service sector facilities (X11). On the other hand, the dependent variables (Y1-Y5) represent the changes observed due to COVID-19 across various domains. These are changes in economic factors such as income per acre (Y1), changes in production area (Y2), changes in farm technology usage (Y3), responses to market conditions (Y4), and changes in farm management practices (Y5).

Data were collected from 50 respondents during the peak of the pandemic, with 25 respondents from Chintamani taluk and 5 respondents each from the remaining taluks. A pretested structured interview schedule was employed to gather information from the respondents. This schedule, developed based on the study's objectives and variables, underwent pretesting in a non-study area. Modifications were made post-pretesting in consultation with experts and officials to ensure its effectiveness and relevance. The interview schedule comprised both open-ended and closed-ended questions, offering flexibility during the interviews and covering topics such as demographic details, economic factors, farm characteristics, water availability, crop cultivation, health and sanitation, and access to services.

Statistical analysis was a crucial component of this study, employing

various measures and methods to analyse the collected data comprehensively. Initially, the mean was calculated to determine the central tendency of the dataset, providing an average baseline. Standard deviation was then utilized to assess the variability or dispersion of data points around the mean, offering insights into the dataset's spread. The coefficient of variation was employed to measure variation independent of measurement units, enabling comparisons across different populations. Importantly, stepwise regression analysis, which is mainly focused in this paper, was emphasized to identify the most influential variables affecting the dependent variables. This method sequentially adds or removes independent variables based on their statistical significance, providing a more refined and interpretable regression model. Furthermore, correlation analysis using Karl Pearson's coefficient was conducted to examine relationships between variables, distinguishing between positive and negative correlations. The regression analysis, particularly stepwise regression, facilitated the exploration of potential causal relationships between variables, offering valuable insights into the factors impacting rural livelihoods during the pandemic.

The study provides a detailed analysis of the socio-economic impact of the COVID-19 pandemic on rural communities in Chikkaballapur district. The findings highlight the challenges faced by farmers and rural inhabitants in terms of economic losses, changes in agricultural practices, and access to essential resources and services. The rigorous statistical analysis, particularly the emphasis on stepwise regression, enabled a nuanced understanding of the complex relationships between various factors affecting rural livelihoods during these unprecedented times. The study underscores the need for targeted interventions and policy measures to support rural communities in adapting to the new normal and building resilience against future challenges.

Stepwise regression is a statistical method used in predictive modelling to systematically select the most relevant independent variables that optimize prediction accuracy while minimizing the number of variables included in the model [11]. This method iteratively adds or removes independent variables based on their statistical significance, typically assessed through F-statistics and tolerance levels. It aims to identify the variables that have the strongest association with the dependent variable, often measured by the coefficient of determination (R^2). Stepwise regression includes procedures such as forward selection and backward elimination, where variables are either added or dropped based on their importance in explaining the variance in the dependent variable. Despite its popularity, stepwise regression has inherent limitations, including issues related to multicollinearity, biased significance levels, and the potential for overfitting. Therefore, caution was exercised when interpreting and applying the results of stepwise regression analyses, ensuring that the findings are not merely statistical artefacts but are theoretically meaningful and robust [12].

Results and Discussion

The stepwise regression analyses conducted across three different models shed light on the influential factors affecting changes in economic factors (Y1), farm technology (Y3), and farm management (Y5). The remaining two dependent variables were eliminated in the process of stepwise regression.

For changes in economic factors (Y1), the analysis revealed that a change in farm

management (Y5) was a significant predictor, accounting for approximately 12.4% of the variance in economic changes (R^2 = 0.124, Adjusted R^2 = 0.106, Std. Error = 3.704). This suggests that alterations in farm management practices have a recognizable impact on economic outcomes.

Similarly, when examining changes in farm technology (Y3), two variables emerged as significant predictors: change in production (Y5) and health and sanitation facilities (X10). Together, these variables accounted for approximately 19.7% of the variance in farm technology changes (R^2 = 0.197, Adjusted R^2 = 0.162, Std. Error = 1.898). This indicates that improvements in production methods and health and sanitation facilities play crucial roles in technological advancements on farms.

For changes in farm management (Y5), three variables were identified as significant predictors: age (X1), education (X2), and changes in economic factors (Y1). These variables collectively explained approximately 31.5% of the variance in farm management changes (R^2 = 0.315, Adjusted R^2 = 0.271, Std. Error = 2.196). The results suggest that older age, higher education levels, and economic factors contribute significantly to the evolution of farm management practices.

These stepwise regression analyses underscore the multifaceted nature of factors influencing agricultural practices. Changes in farm management, technological advancements, and economic factors are intricately linked, emphasizing the need for holistic approaches in agricultural development and policy-making.

Table 1: Stepwise regression analysis: change in economic factors (Y_1) with 11 causal variables

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1. Y5	.353[a]	0.124	0.106	3.704
a. Predictors: (Constant), y5				
b. Dependent Variable: y1				

Table 2: Stepwise regression analysis: change in farm technology (Y_3) with 11 causal variables

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1. X10	.354[a]	0.125	0.107	1.960
2. Y2	.443[b]	0.197	0.162	1.898

a. Predictors: (Constant), x10
b. Predictors: (Constant), x10, y2
c. Dependent Variable: y3

Table 3: Stepwise regression analysis: change in farm management (Y_5) with 11 causal variables

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1. X2	.369[a]	0.136	0.118	2.415
2. X1	.493[b]	0.243	0.210	2.285
3. Y1	.562[c]	0.315	0.271	2.196
a. Predictors: (Constant), x2				
b. Predictors: (Constant), x2, x1				
c. Predictors: (Constant), x2, x1, y1				
d. Dependent Variable: y5				

Conclusion

The study highlights the profound effects of the COVID-19 pandemic on farming and agricultural practices, revealing shifts in economic factors, production, farm technology usage, market responses, and farm management. Factors like age, education, family size, farm size, income, farm vehicles, farm animals, water availability, crops grown, health, and sanitation were assessed. Stepwise regression analysis identified variables such as changes in farm management and economic factors as significant predictors of these shifts. The findings emphasize the need for adaptive strategies and support for farmers to navigate these challenges effectively, underscoring the importance of resilience and innovation in sustaining the agricultural sector amidst global uncertainties.

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