



Appraisal of Farm Diversification and Livelihood System of Bihar (India)

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ARTICLE INFO

Keywords: Farm diversification, Simpson index of diversification, Ordinal regression, Dairy farmers, Constraints

<http://doi.org/10.48165/IJEE.2023.59315>

Conflict of Interest: None

ABSTRACT

The paper examines state-level trends in Bihar for determining patterns in farm diversification for the period 1990-91 to 2018-19, using the Simpson Index of Diversification (SID) and ordinal linear regression analysis to analyse the determinants. The study, conducted in the year 2022, reported that the cropping system at the state level is transforming from food grains to different high-value crops and allied farming sectors. The transformation was not uniform across the regions. The SID values have demonstrated how the agricultural economy has been more diverse over time, with some variations in the production of food and non-food crops. The result of multiple regressions has revealed earning members, social work participation, and government donations to be the major determinants of farm diversification, and various constraints were identified using the Garrett ranking method. Hence, the study suggests that policy support for the development of dairy farmers should be more focused on increased cropping intensity, insurance protection, investments in agricultural research and education, and technology development.

INTRODUCTION

Farm diversification refers to the efforts made by individuals and households to incorporate current portfolios of income-generating activities that will support the livelihood and improve their standards of living. Recent research shows that a key strategy for decreasing poverty and raising people's standards of living is the diversification of sources of income (Ezung, 2021). Rural communities tend to diversify more because they cannot rely just on agriculture for existence. As a result, they work in the forest industry as wage workers and are also engaged in fishing, crafts, and other activities to increase their income. Diversification in urban areas is generally lower than in rural areas, as urban households rely on one or two high-income jobs (Ersado, 2006). In developing countries like India, small and marginalized farmers' land-based livelihoods are becoming increasingly unsustainable in emerging nations like India since the land can no longer provide their families' demands for food and fodder (Hiremath, 2007). So, people

can engage in different activities and earn enough to sustain themselves. Livelihood diversification occurs in both agricultural and non-agricultural activities i.e. cultivation of high-value and multiple crops. Starting small enterprises or deciding on non-agricultural careers like temporary employment or migration are non-agricultural activities (Khatun & Roy, 2012). Modern rural livelihood programmes in developing nations prioritize diversification (Reardon et al., 2001; Barrett et al., 2001; Niehof, 2004). In India livestock provides a substantial contribution to livelihood security and symbiotically contributes to its growth. Livestock is an integrated part of the agricultural systems that stand as the pillar of the farm family. According to economic survey report (2019-20) in India about eight crore farmers are directly dependent upon livestock for their livelihood. It contributes to 4.35 per cent of GDP and 29.35 per cent of the total agricultural GDP. It has also registered about 8.15 per cent growth in livestock sector during the last five years. In addition to a fast economic growth, a wide area difference in household income found among

the different regions of country. The Indian growth pattern has been highly varied in economic, social, institutional and agricultural at state level. "Aspirational districts" program has been launched by NITI Ayog (2018) as a bold and promising strategic step towards least developed regions across the country and to remove the huge chasm in the performance of different states. Development by means of diversification is a compulsory requirement for any developmental strategies for such areas (Minot et al., 2006). Bihar's economy is mostly reliant on agriculture. Including forestry and fisheries, agriculture provided 18.1 per cent of the state's GDP in 2016–2017 and employed 77 per cent of the workforce, which is significantly more than the national average (www.krishi.bih.nic). Even if the state is self-sufficient in food grains, the rural community's economic situation is still miserable. The focus of this study was to provide information that will aid the policy makers in designing and developing rural upliftment a strategy and public investment programmes that will assist rural people in diversifying their sources of income.

METHODOLOGY

The Simpson Index of Diversification (SID) was calculated using information gathered on the worth of output for the years 1999–2000 to 2018–19 to assess the level of diversification both generally and across various sectors. For the period, i.e. 1999-00 to 2018-19 for Bihar, data on the value of output of agriculture and related activities were gathered from the Ministry of Statistics and Programme Implementation (MoSPI), Government of India. The constraints study was carried out in aspirational districts of Bihar. The set of four districts also representing different types of agro-climatic, socio-economic conditions, and having lowest per capita agricultural income of the state was selected from all the zones. Two blocks from each district and two villages from each block were selected randomly. Twenty households of dairy farmers in each village were randomly selected to representing a total sample size of 320. Based on available literatures, survey reports and discussions with various stakeholders a semi-structured questionnaire was prepared pre-tested prior to the survey. Regression model using ordinal least square techniques was applied to identify determinants of livelihood diversification. In this study, OLS assumptions were establishing a causal link between the dependent and predictor variables, the relationship was carefully examined and held. For instance, the model's factors are presumed to be linear and its variables are selected at random. Additionally, it is expected that there is no significant linear correlation between the explanatory variables presented and the situational mean value is zero for error term. However, it was presumed that there would be homoscedasticity in the error terms and no multicollinearity with the treatment variables. The regression model is given in

$$\text{Equation (1): } D_{ij} = \beta_0 + \beta_i X_i + \mu \quad \dots (1)$$

Here, D= is the responding variable indicating diversification of household, i = measured in the number of activities j, β_0 = referred as constant, β_i = defined as vector of parameter, X_i = Vector of independent variables and, μ = is the disturbance term

Collected information was analyzed using a range of statistics and econometrics tools. "Farm Diversification" was quantified as

the process through which farm or rural people build an ever-diversifying collection of ventures and possessions to thrive and raise the level of living condition. Those respondents who had livestock as a part of their farm diversification were treated as respondents during the data collection process.

Farm diversification of was quantified with the help of 'Simpson Index of Diversity' (1949). The Simpson Index of Diversity (SID) is operational as:

$$SID = 1 - \sum_{i=1}^n P_i^2$$

$$P_i = \frac{\text{Value of output for } i^{\text{th}} \text{ crop / enterprise}}{\text{Total value of output from all agriculture and allied enterprises in farm}}$$

Where, P_i represents as the proportion of income generating from source I. However, SID value always ranges between 0 and 1. The statistical tools used for constraint analysis was Garrett's ranking method to help find the most important factors influencing the survey variables. Standard Garrett's formula that converts ranks into percent was used.

RESULTS AND DISCUSSION

Current livelihood systems pursued by the farmers

It is evident from the Figure 1, that among the several means of livelihoods used by the respondents in the research area, integration of agricultural farming and livestock farming is found to be maximum preferred livelihood system, followed by (31.87%) of dairy farmers. This result was found to be in concordance with Khan et al., (2007). The second most significant livelihood system being practiced by the (19.06%) of the dairy farmers found to be the alignment of livestock farming and business activities. The integration of livestock rearing and wage labour was reported for (14.06%) of the dairy farmers. Agricultural farming along with cattle-rearing and wage labour was reported by (11.25%) of the dairy farmers. Agricultural farming along with livestock farming and government and private service was practiced by (6.87%) of the farmers while the combination of service and cattle rearing was followed by (11.87%) of the respondents. The least common kind of subsistence, practiced by only (5.00%) of respondents, was crop production together with livestock rearing and business. The findings suggest that respondents pursued agricultural production as a significant source of livelihood in all seven of the livelihood systems that were common in the study region, except in the livelihood system of livestock rearing. Most of the respondents from the whole sample were discovered to be working in agriculture sector. This shows that agriculture farming is still highly significant means of income generation for farmers. This might be because most of the farmers were having marginal land holding. They were not in a position to meet the expenditure required to run the family with only one source of income. Hence most of the households earned a living by maintaining a diversified pattern of occupations viz., on farm activities, wage employment, services, and small enterprises. The study was found in concordance with Parmanand et al., (2012) explained that (Crop production + Livestock) livelihood system was followed by most (28.75%) of the farmers.

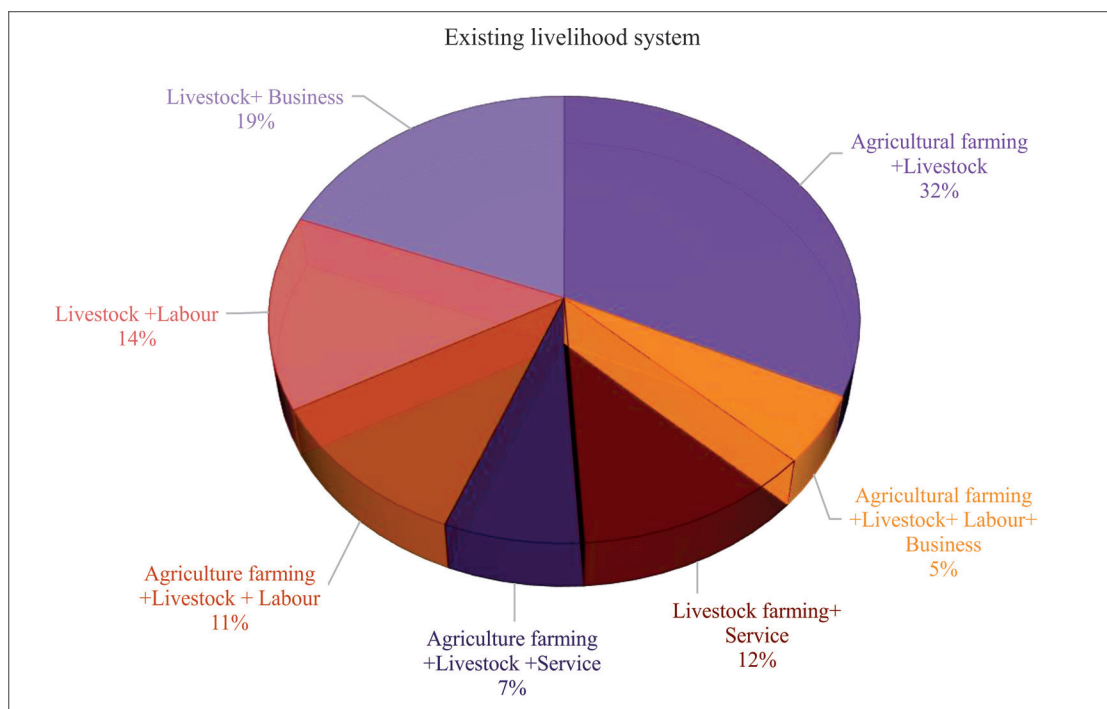


Figure 1. Distribution of respondents on the basis of existing Livelihood systems

Extent of farm diversification, as prevalent in the study area

The extent of farm diversification across the year over last 19 years in the state is presented in Figure 2. The value of Simpson Index of Diversification (SID) indicates the diversification value in overall agriculture including horticulture and livestock. Among cereals and pulses the SID for pulses was found higher in all the years. SID for oilseed was seen increasing over few years followed by declining trend in 2009-11 and 2017-19. Similarly, the SID value of cash crop in the state was found to decreasing from 2011 onwards to 2019. SID for pulses and spices and condiments was seen almost similar round the year. The diversification was seen most for vegetables as compared to fruits in the state the mean value of SID for vegetables was 0.727 while for fruits it was found to be 0.664. The SID for byproduct was drastically low compared to the other entire sector share. The diversification was seen most for vegetables, spices and condiments, pulses, cash crop as compared to fruits, cereals, oilseeds in the state. Though diversification in agriculture can be seen in state but individual sub sector wise Simpson index of diversification gives different picture.

The SID for overall agriculture and allied in Bihar was, found to be of medium level with an average of 0.543 over last twenty years (Table 1). However, the value of SID was found to be increasing over last few years from 2013 onwards for overall agriculture and allied sector. The Table 1 shows a declining trend of Simpson Index of diversification for Livestock over 2014 onwards in Bihar which depicts that state indicates shifting towards specialized production of these commodities. However, SID values ranging from 0.71 to 0.80, is reported for Indian states like Rajasthan, the Jammu and Kashmir region, Uttar Pradesh, Jharkhand, Chhattisgarh, Bihar, and Himachal Pradesh, showing a medium level of agricultural diversification (Sen et al., 2017).

Table 1. Sector wise Simpson Index of Diversification for Agriculture, Livestock, Fishery, and Overall Agri and allied sectors of Bihar state

Year	SID Agriculture	SID Livestock	SID Fishery	SID Agri and Allied
1999-00	0.532	0.525	0.000	0.511
2000-01	0.588	0.520	0.000	0.510
2001-02	0.591	0.521	0.000	0.527
2002-03	0.603	0.517	0.000	0.538
2003-04	0.613	0.502	0.000	0.540
2004-05	0.646	0.438	0.000	0.541
2005-06	0.619	0.439	0.000	0.540
2006-07	0.573	0.421	0.000	0.534
2007-08	0.596	0.416	0.000	0.535
2008-09	0.547	0.419	0.000	0.536
2009-10	0.616	0.419	0.000	0.536
2010-11	0.626	0.396	0.000	0.534
2011-12	0.639	0.382	0.000	0.533
2012-13	0.634	0.383	0.000	0.534
2013-14	0.654	0.400	0.000	0.560
2014-15	0.652	0.383	0.000	0.567
2015-16	0.620	0.347	0.000	0.568
2016-17	0.677	0.371	0.000	0.578
2017-18	0.599	0.347	0.000	0.569
2018-19	0.620	0.347	0.000	0.574

Determinants of farm diversification

The important determining elements discovered that influences, farm diversification activities between the dairy farmers by using the ordinal linear regression analysis. Findings of regression analysis depicts that the coefficient of age (years), total number of family members and qualification of family members has an extreme influence, however statistically it was found to be non-significant

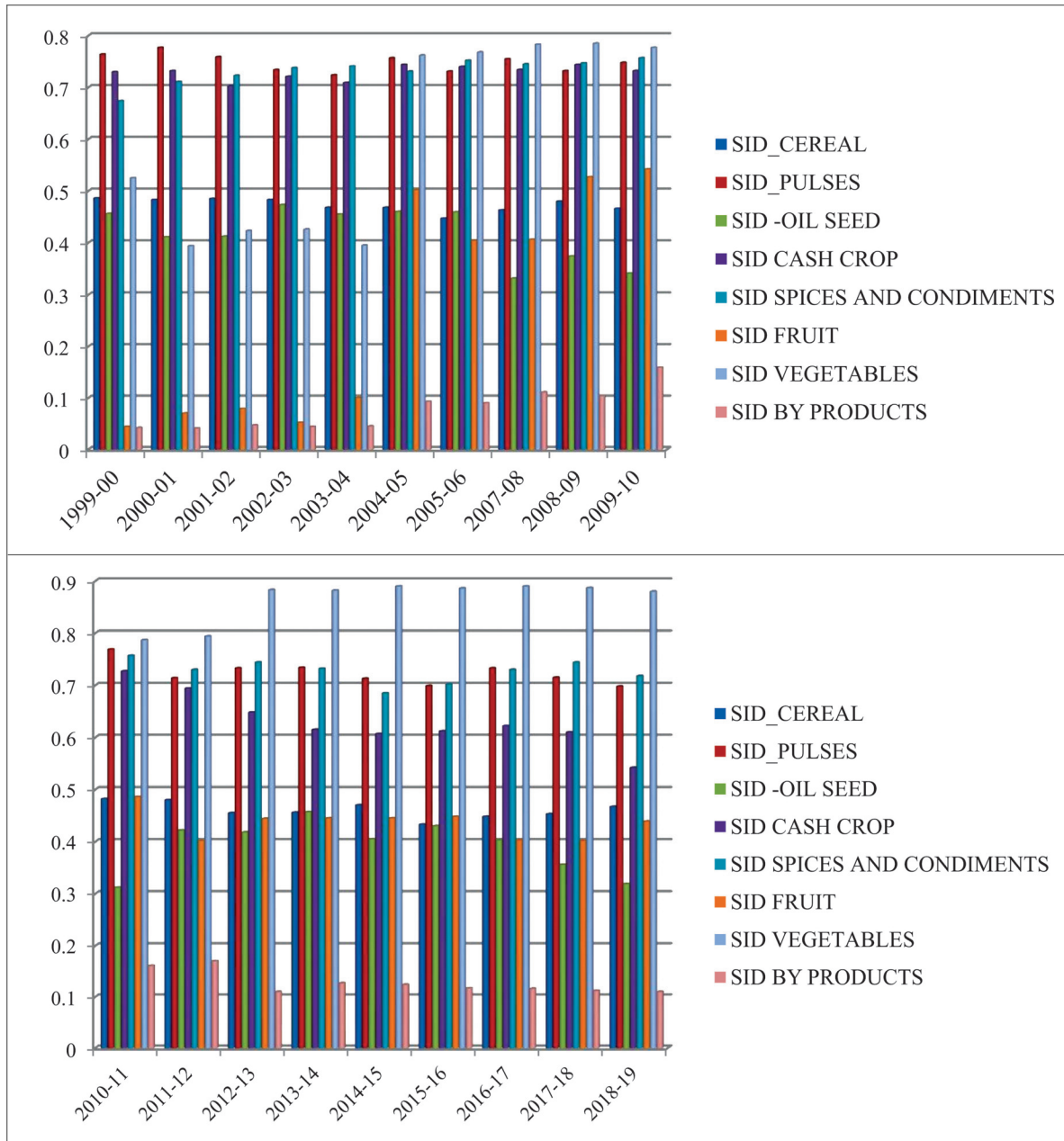


Figure 2. SID of various crops over last 19 years in Bihar

on the scale of accepting farm diversification activities (Table 2). By implementing on-farm and off-farm activities, qualified or educated family members are able to rapidly determine the most beneficial alternative economic pursuits for the family's well-being. But it was determined that the computed coefficients were not statistically significant. However, study conducted by Mentamo & Geda (2016) farming experience facilitates to accept different suitable income generating activities in the previous years. Families having a large number of members are benefited by having more human resources that can be used to engage in non-farm activities. An increase in the number of earners in a household has statistically shown to be positive with the number of diverse activities, as shown by the estimated coefficient of total earning members (Table 2). This finding is allied with the result of (Mottaleb & Ali,

2018). The interpersonal relationships and network of dairy farmers develops as a consequence of participation in various social activities. In the study area, it was found that venture diversification is higher among dairy farmers who often participated in social activities. A comparable understanding is assumed by (Ellis, 2000) since the government provides all the necessary social facilities, the work of government assistance (financial and directional) gives good contribution towards expanding diversified activities (Smith et al., 2001), and the crucial role of government schemes and support is reported to be statistically significant for the dairy farming community. The livelihood diversification was also positively impacted by income (earning members of the family). When one's financial status is secure, they are better positioned to benefit from innovative strategies that increase their capacity

Table 2. OLS regression table

Variable	Coefficients	Standard error	t	P> t
Age (X ₁)	0.007	0.01	0.42	0.64
Education (X ₂)	0.024	0.06	0.44	0.63
Family member (X ₃)	0.019	0.11	0.15	0.78
Earning members (X ₄)	0.452*	0.25	1.84	0.03
Educated family member (X ₅)	0.231	0.18	1.35	0.19
Loan (X ₆)	-0.167	0.17	-0.45	0.63
Training (X ₇)	-0.230	0.07	-0.55	0.58
Social work participation (X ₈)	0.560*	0.38	1.69	0.05
Health/financial problem (X ₉)	0.299	0.45	1.12	0.27
Government donation (X ₁₀)	0.867**	0.33	2.46	0.01
R ²	0.58	-	-	-
F value	2.56	-	-	-
Observation	320	-	-	-
Mean VIF	1.75	-	-	-

Note: ** and * - significance at one and five per cent, respectively

Figure 3. Mean Simpson Index of Agriculture, Livestock & Agri & allied

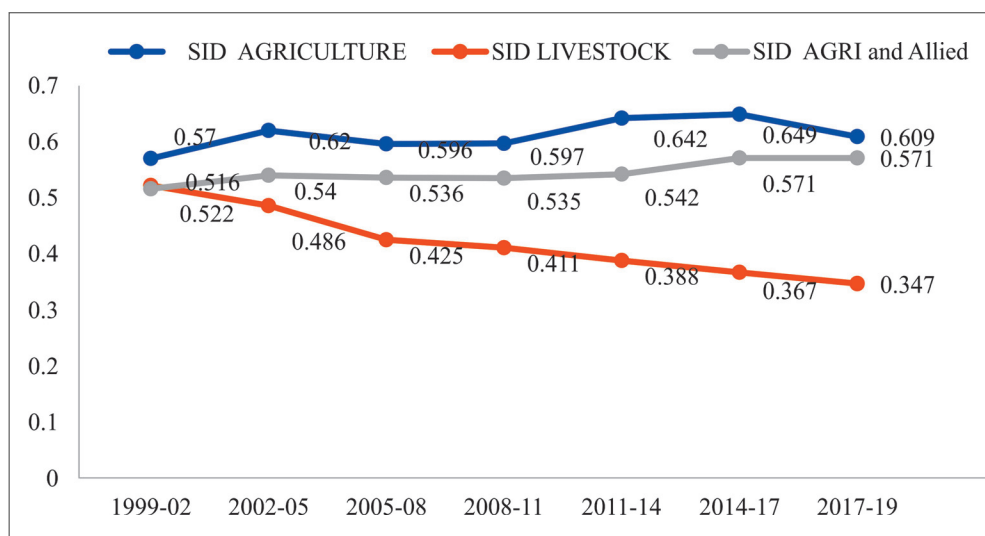


Table 3. Distribution of respondents according to Constraints

S.No.	Statements	GMS	Rank
1	Limited availability of credit services	45.39	VI
2	Poor coordination and collaboration among stakeholders	53.15	III
3	Lack of technical support from relevant organizations	60.55	II
4	High charges by veterinarians for treatment of animals	63.80	I
5	Poor access to market and lack of working capital	48.27	IV
6	Scarcity of farm land	40.93	VII
7	Poor infrastructure, including inadequate roads and transportation etc.	36.98	VIII
8	Lack of awareness and training programme	46.58	V

for earning a living. The current finding is consistent with (Dagar & Upadhyay, 2022; Gautam & Jha, 2023).

Constraints of rural livelihood diversification

There are several barriers to successful livelihood diversification in the area, despite the fact that it is a crucial plan of survival for rural households to maintain livelihoods and reduce vulnerability. One of the main obstacles to livelihood diversification in the area, according to focus group participants, is the high

charges by veterinarians for treatment of animals, as well as issues with roads and transportation, the scarcity of farmland, the lack of technical support from relevant organisations, the limited availability of credit services, the poor connectivity between rural and urban areas, the lack of market access and the lack of working capital, the lack of awareness, and poor coordination and collaboration among stakeholders. Data in Table 3 depicts the ranking of different constraints identified by respondents. It was found that “High charges by veterinarians for treatment of animals”

was ranked I by the respondents while “Poor infrastructural facilities such as proper road, transportation facilities etc.” was ranked least important by the respondents with Garrett mean score value of 36.98. The findings of the research were found in line with Das et al., (2014; Gireesh et al., (2019) & Gupta et al., (2020) who also reported that lack of appropriate marketing facilities, and insufficient number of demonstrations of new technologies, were some major challenges identified by the respondents. However according to the study conducted by Mishra et al., (2023) depicted that poor knowledge on pest and disease control and low profit were the major challenges faced by the respondents.

CONCLUSION

Unchecked population growth, smaller farm sizes, reliance on rainfall, irregular rainfall patterns, and low returns from farming activities have forced farmers to engage in a variety of income-generating activities in order to sustain and develop their living standard while also overcoming obstacles to their livelihoods. The study comes to the conclusion that enhancing livelihoods, increasing food security, and reducing poverty in the study region cannot be accomplished in the area alone through the agricultural sector. Therefore, it is determined that a comprehensive development strategy that supports effective livelihood diversification is essential and necessary. The main focus of policies and actions should be aimed at improving the livelihood of farming communities through building and growth of rural infrastructures, such as the road network, market center, strengthening rural-urban linkages, accessibility of financial services trainings, as well as awareness-raising initiatives and institutional arrangements.

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