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Research Paper

Exploring Farmers' Behavior and Intention to Adopt Sustainable Agriculture Practice in Downstream Villages of Vrishabhavathi River Basin

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ABSTRACT

The study delves on evaluating Farmer's behavior and intention to adopt sustainable agricultural practices in the downstream villages of Vrishabhavathi river basin. The study, spanning 16 villages within the stream's command area, explores factors shaping farmers' behavior and intention using the Theory of Planned Behavior (TPB). The TPB, a socio-psychological theory, proposed by Ajzen (1991), highlights that human behavior and intention is influenced by these three factors—attitudes, subjective norms, and perceived behavioral control. The study aims to shed light on key determinants shaping farmers' intentions to adopt sustainable agricultural practices in response to challenges like urbanization impact and climate change effects in peri-urban agriculture. By employing TPB within this unique context, the research contributes to understanding farmers' decision-making processes towards sustainable agriculture practices in the face of multifaceted challenges.

Keywords: *Theory of planned behavior, Sustainable agriculture practice, climate change impact, Peri-urban agriculture, polluted reservoirs*

In the global context of agriculture, sustainability has become a paramount concern as the world grapples with effects of climate change, population growth, and environmental degradation. The imperative to transition towards sustainable agriculture practices is not only critical for ensuring food security but also for mitigating the ecological footprint of farming activities.

Agriculture, the backbone of the Indian economy, is undergoing dynamic transformations, particularly in semi-arid peri-urban regions where urbanization and climate change significantly impact rural landscapes (Qadir *et al*., 2007; Biswas, 2008). Climate change and extreme climatic events are anticipated to impact agriculture and food security, leading to reduced food availability, stability, and lowered utilization and access, as outlined by the Intergovernmental Panel on Climate Change (IPCC) in 2014, whereas the nexus between urban activities and the peri-urban environment becomes pronounced, presenting a pressing challenge—reservoir water pollution from urban influences (Madhav *et al*., 2020).

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As urban centers encroach upon the outskirts, the importance of water resources becomes crucial. Compounding the issue, the prevalent practice of utilizing polluted reservoir water for agricultural irrigation emerges. Farmers, facing the scarcity of freshwater, resort to wastewater irrigation sourced from contaminated reservoir canals. This practice, born out of necessity, raises critical concerns about the potential transfer of pollutants from water to soil and, ultimately, to the crops that form the lifeline of local agriculture (Lu *et al*., 2015; Lehman *et al*., 2015; Mishra *et al.,* 2019). In response to these challenges, the adoption of sustainable agricultural practices has become imperative for the economic, social, and environmental well-being of the region (O Adisa *et al.,* 2024).

In the dynamic intersection of agriculture, climate change, and human behavior, this research delves into the adoption of sustainable agricultural practices in the downstream villages that are adjacent to the canals that draw water from the Vrishabhavathi River. Spanning 16 villages (Abbanakuppe, Byramangala, Ramanahalli, Gopahalli, Kadashikoppa, Bannikuppe, Cheelur, Allalasandra, Thamasandra, Kanakapura, Aralalu, Kebbehalli, Kokkarehosahalli, Nallahalli, Hukunda and Purushagondanahallli), the study explores the intricate web of factors shaping farmers' intentions and behaviors upon the Theory of Planned Behavior (TPB).

Agriculture has historically been fundamental to the region's livelihood, relying on a combination of rainfed and surface water irrigation. However, urban sprawling is posing a significant challenge: sewage runoff from the city contaminates catchments and agricultural lands in the downstream. This convergence of urbanization impact and the effects of climate change has given rise to a series of local challenges directly affecting agricultural practices.

Numerous questionnaire-based research surveys have been conducted in the Vrishabhavathi River basin to better understand the socio-demographic and farm characteristics of local farmers. The present study seeks to delve deeper into the primary factors influencing farmers' intentions to adopt sustainable agricultural practices in the Vrishabhavathi downstream River basin. To achieve this, the study employs the Theory of Planned Behavior (TPB), a socio-psychological theory that provides insights into the cognitive processes underlying human decision-making.

It's worth noting that TPB has gained substantial traction in environmental science research, with Bosnjak *et al*. (2020) reporting that, as of April 2020, a total of 280 environmental science studies have made use of the Theory of Planned Behavior, according to the web of science bibliographic database. By applying TPB within the unique context of the Vrishabhavathi river basin, this study aims to shed light on the key determinants shaping farmers' intentions to adopt sustainable agricultural practices, thereby contributing to the region's resilience and sustainability in the face of multifaceted challenges.

The research paper is organized into following 6 section; Theoretical background of TPB; Questionnaire and Survey design; Data analysis using SmartPLS-4; Socio-demographic assessment; Assessment of farmer's general attitude towards climate change and local challenge impacts on agriculture and sustainable agriculture practice (SAP); TPB assessment using PLS-PM measurement & structural model.

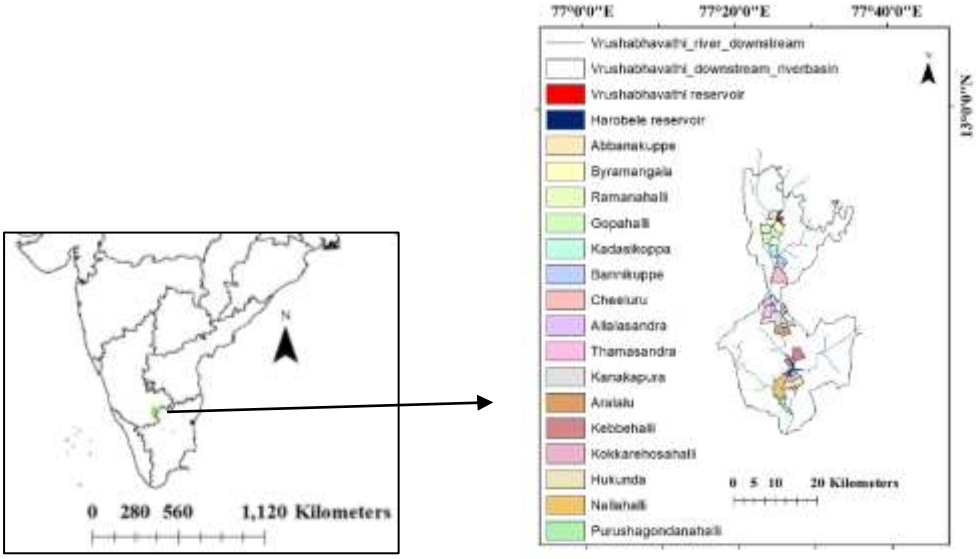

Figure1. Study area map showing the locations of villages taken-up for survey in Vrishabhavathi river basin.

THEORETICAL BACKGROUND

Theory of Planned behavior (TPB)

Theory of Planned Behavior (TPB) is a widely recognized and influential psychological theory in studying human behavior developed by Icek Ajzen in the late 1980s. According to TPB, human behavior is influenced by three kinds of belief factors: beliefs about the likely outcomes and experience associated with the behavior (Behavioral belief) which subsequently gives positive/negative Attitude, beliefs about the social expectations and behavior of significant others (Normative beliefs) which subsequently gives subjective norm, and beliefs on the factors that may facilitate or impede the behavior this subsequently gives perceived behavioral control (Ajzen, 1991; Ajzen, 2012; Ajzen, 2020). Accordingly, Behavior is influenced by intention and perceived behavior control of that behavior (Figure 2) and when it comes to intension, it is the joint function of Attitude, Subjective norm and perceived behavior control (Ajzen, 2012).

Ajzen (1991), calculated salient beliefs (behavioral belief, normative belief and control belief) through the expectancy-value model. According to which, in case of attitude towards certain behavior, each attribute of behavioral belief links to certain outcomes i.e., a sum of assessment of the likely outcome (ao) multiplied with belief strength of the outcome (bs) gives the attitude. Similarly, normative beliefs pertain to the probability of receiving approval or disapproval from significant individuals or groups when engaging in a specific behavior. The strength of each normative belief (ns) is multiplied by the individual's motivation to comply (am) to the opinions of the respective referents. Consequently, the subjective norm (SN) is intricately linked to the cumulative sum of these products calculated across all salient referents. Higher the individual's perseverance towards the available resources and opportunities while expecting fewer hindrances or obstacles, the stronger their perceived control over a particular behavior.

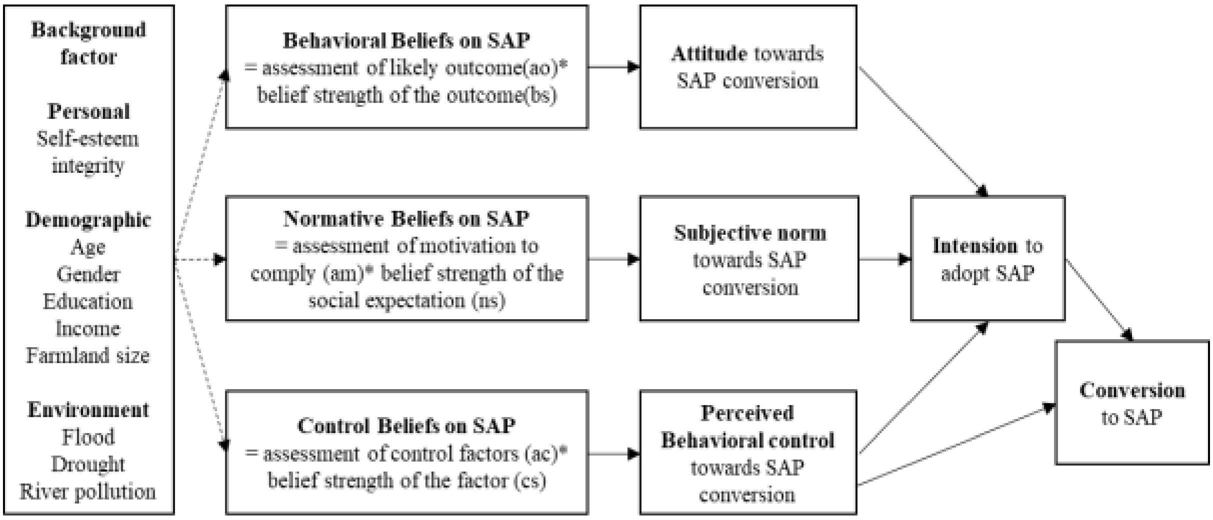

Figure2. Theory of Planned Behavior (TPB) model for adapting Sustainable Agriculture Practice (SAP) by farmers' in Vrishabhavathi downstream river basin.

MATERIALS AND METHODS

Questionnaire and Survey design

On the basis of information collected through focal group discussion and expert suggestion, questionnaire is constructed to comprehend farmers insight on sustainable agriculture practice and impact of climate change and local challenges on agriculture practice in the region. Questionnaire consist of 3 parts; socio-demographic status of farmer, general attitude of farmers towards climate change and local challenges impact on agriculture and farmers intention to adopt sustainable agriculture practice (TPB) in their farm practice in next 5 years. Through focal group discussion change in rainfall pattern and rise in temperature are found to be common climate change experiences in the region and reservoirs' untreated sewage water is found to be major challenge for local agriculture practice. Through the expert suggestions, following five sustainable agriculture practice are considered as suitable sustainable agriculture practice (SAP) for the region, 1. Reduction in irrigation with farrow irrigation practice, 2. Mulching, 3. Intercropping with Nitrogen fixing shrubs, green manure and cover crops, 4. Agroforestry practice and 5. On-farm compost pit for farmyard manure and vermicompost. Theory of Planned Behavior (TPB) questionnaire is constructed to reflect the following latent constraints behavioral beliefs, normative beliefs, control beliefs, attitude, subjective norms, perceived behavioral control, intension to adopt sustainable agriculture practice and conversion to sustainable agriculture practice. Responses are evaluated using variance-based Partial Least Square Path Modeling (PLS-PM) in SmartPLS 4 statistical package. Questionnaire for TPB latent construct (see Figure 2) are framed in a way that represent farmers' response towards adopting these above-mentioned practices. Question flow was made for smooth interaction and questions on farmers' general attitude towards climate change, local challenges and sustainable agriculture practices were also captured to get as much information as possible from farmers. Sensitive questions on socio-demographic and farm characteristics were also included in the survey for the better understanding of household background. The main focus of this survey was to explore the components of TPB and to find their influence in farmers' behavior for adopting sustainable agriculture practice within next five years.

In order to get an insight into farmers intention to adopt SAP in their farm practice, 125 farmers from 16 villages in river Vrishabhavathi rivers' downstream basin are selected

(Figure 1). Two-stage cluster random sampling technique are employed. In stage-one, 16 random villages adjacent to the river stream in downstream basin are selected. In stage-two, from each selected village, 3 categories of farmers are grouped based on their land holdings (marginal/small, medium, and large). In each village, random samples are taken from the stage-two clusters and the number of samples varied between 1 and 3, according to the size of the villages. Data collected via face-to-face interviews with the help of trained interviewers. These interviews were conducted either directly on the farmers' land or inside their homes, ensuring that proper consent was obtained and maintaining the participants' interest and cooperation throughout the process. This approach helps ensure that the survey captures a representative and diverse sample of farmers from the region while maintaining proper ethical and consent procedures during data collection.

Data analysis using SmartPLS-4.

To analyze TPB variables, a variance-based Partial Least Square Path Modeling (PLS-PM) using SmartPLS 4 statistical package is used. Measured variables (yellow rectangle) are called measurement model/outer model whereas the latent variables (blue circle) are called structural model/inner model. In the measurement model, measured variables relationship with the latent variables are considered have reflective correlation. In the structural model, the path relationship between the independent latent constructs and dependent latent constructs are represented with arrows pointing from one to other and the path coefficient gives the correlation between the dependent latent construct to independent latent construct and higher-order dependent latent construct to dependent and independent latent construct (Ringle, C., *et.al.,* 2015; Henseler, J., *et.al.,* 2015; Issa, I., & Hamm, U. 2017).

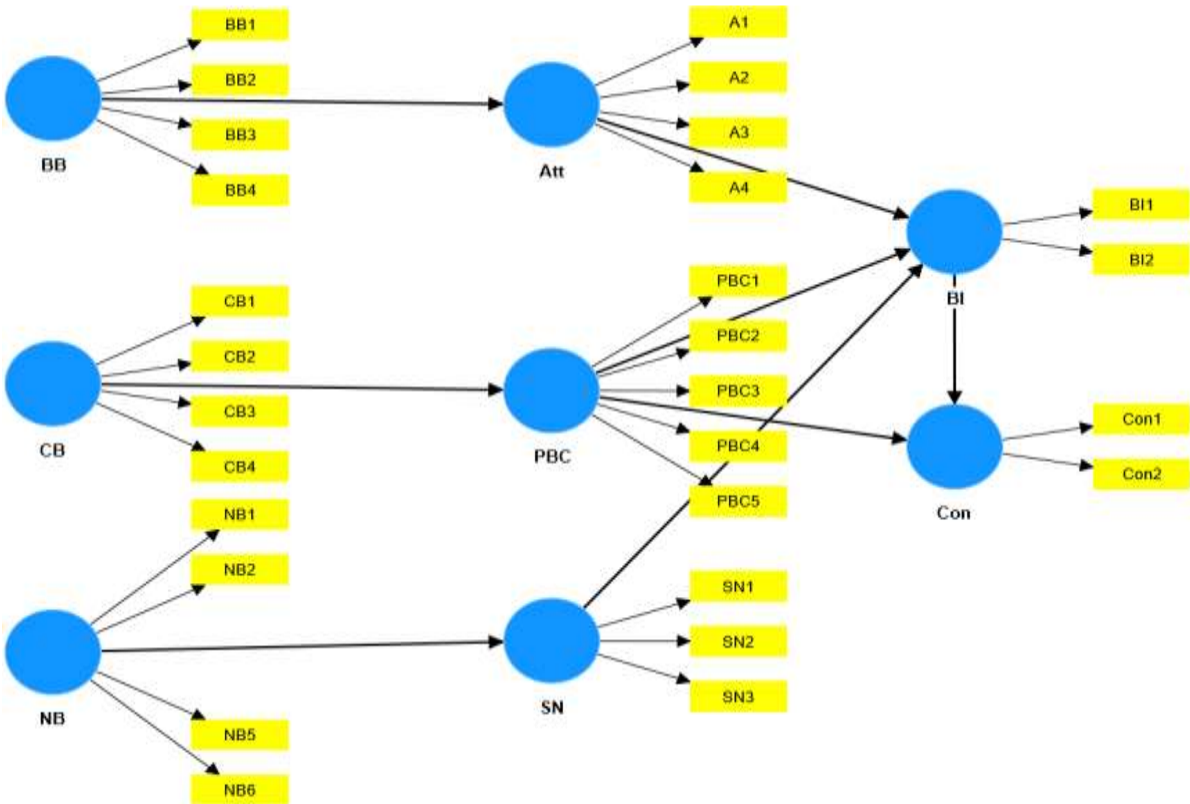

Figure 3. Illustration of structural equation model for TPB. The variables represented by yellow rectangular boxes are measured variables (questionnaire items), while those in blue circles are latent variables.

RESULTS AND DISCUSSIONS

Socio-demographic analysis

Socio-demographic characteristics of farmers provides the key attribute of the population and are presented in Table 2. This table represent that most of the interviewed farmers were males except few. The average age of respondents was 51 and ranged between 18 and 80 years old. 50 % of farmers were above 50 years of age. A significant negative correlation between age and land area (r = -0.004 and p- value= 0.000) states that the older the farmers were, lower were their farm land area. This is practical since farmers of this region would divide their land among their second generation of the family in their old age and keep only a small fragment of land with themselves for agriculture practices.

About 66% of the farmers had some form of education, among which 18% of them completed college education. A significant negative correlation between the age and level of education (r= -0.364 and p-value = 0.000) suggests that the younger the farmers were, higher were their education level. On average household composed of 3 people. Second generation male and his family lived with their older parents in a joint family hence older the farmer is higher were his household size (r= 0.112 and p-value= 0.000).

Out of 122 responses, 98% of farmers relied on farming for their household income, followed by livestock rearing (83%), sericulture (35%), daily wage working (13%), old age pension (12%) and fishing (1%). When introducing the sustainable agriculture practices during interview, 93% of the farmers were willing to practice Intercropping with Nitrogen fixing shrubs, green manure and cover crops, followed by agroforestry (92%), Mulching (54%), On-farm compost pit for farmyard manure and vermicompost (11%) and reduction in irrigation with farrow irrigation practice (7%). About 64% of the farmers responded they are facilitated by schemes and measures from government.

Table 2. Socio-demographic attribute of farmers' in Vrishabhavathi river basin.

Characteristic	%of respondents (*N*=122)
Gender	
0 = female	2.5
1 = male	97.5
Age at the time of survey (years)	
Upto 39	14.8
40-49	35.2
50-59	19.7
60 and above	30.3
Highest education level completed	
2 = SSLC and below	48.4
3 = college/degree	16.4
4 = post graduate	1.6
1 = illiterate	33.6
House hold size (person)	
1=less than 3	25.4
2= 3 to 6	64.8
3= 7-9	7.4
4= above 9	2.5
1=agriculture	98.4

Characteristic	**%of respondents (*N*=122)**
2=fishing	0.8
3=daily wage labor	13.9
4=livestock	83.6
5=sericulture	35.2
6=pension	12.3
Sap you are willing to practice	
1=reduction in irrigation	7.4
2=intercropping	93.4
3=mulching	54.9
4=agroforestry	92.6
5=organic inputs	11.5
Schemes and measures from government being helpful	
0=no	35.2
1=yes	64.8

Assessment of farmer's general attitude towards climate change & local challenges impacts on agriculture and sustainable agriculture practice (SAP).

A 5 scale Likert scale questionnaire set was prepared to understand the general attitude of the farmers towards climate change, local challenges impact on their livelihood and sustainable agriculture practice as resilient practice. Table 3. depicts the general attitude of farmers towards climate change and local challenges statements. About 88% of farmers were aware of change in climate pattern in last few decades whereas 94% of people responded they have experienced climate change impact. 92% of farmers responded polluted water from the reservoir is affecting day to day livelihood.

Majority of farmers disagreed (49%) to GA20 statement. Upon expert suggestion difference of opinion with GA20 statement is compared among farmers of small, medium and large land holders. Out of 24% positive responses, small land holding farmers had higher positive response (11%), than medium (8%) and Large (7%) farm land holders i.e., 11% of small farmers thought conversion to sustainable agriculture practice require high investment cost. Same for the statement GA23 63% farmers agreed that small land holding is convenient to practice sustainable practice. When compared with land holding categories, small farmers had lesser percentage (22%) of agreement than medium (29%) and large (26%) farm land holders. Overall in the region, farmers had positive attitude towards sustainable agriculture practice as resilient practice.

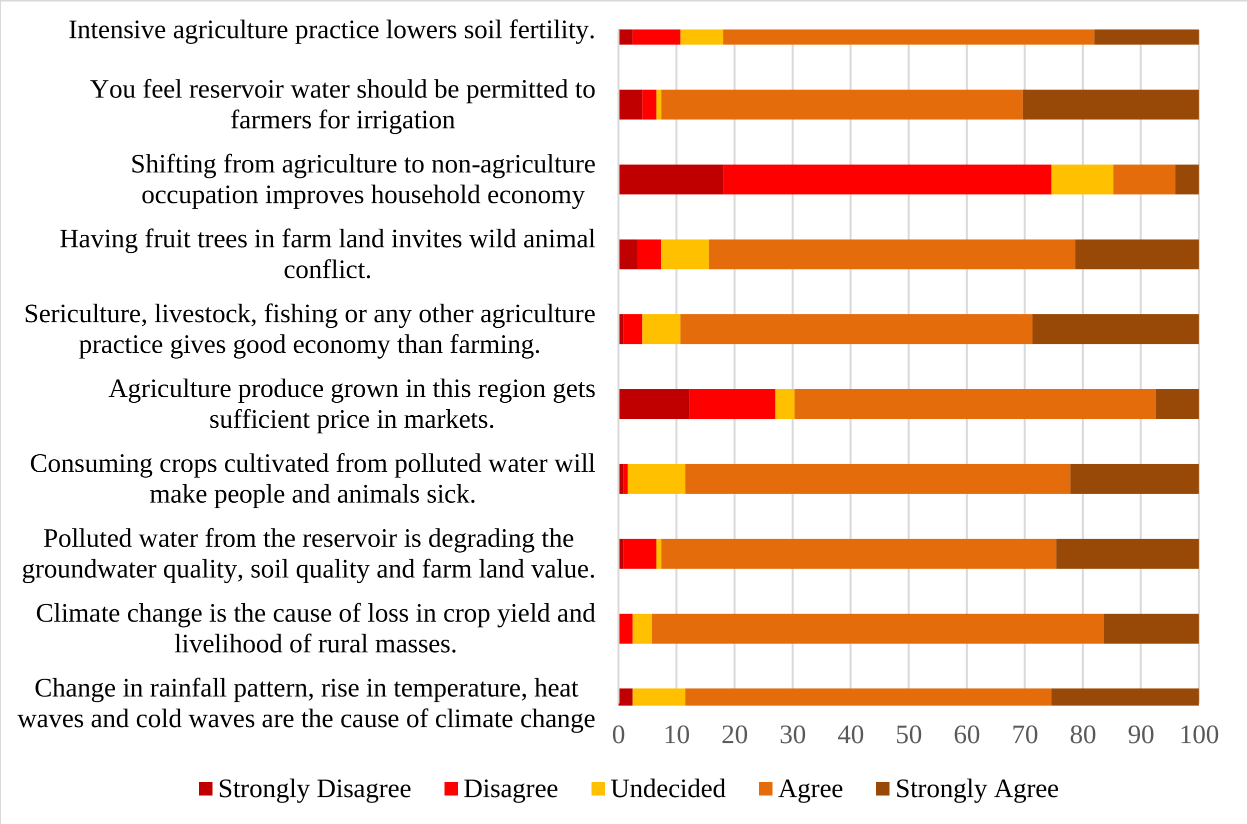

Figure 2: Distribution of response (%) of farmer's general attitude towards climate change and local challenges impacts on agriculture practice in the region.

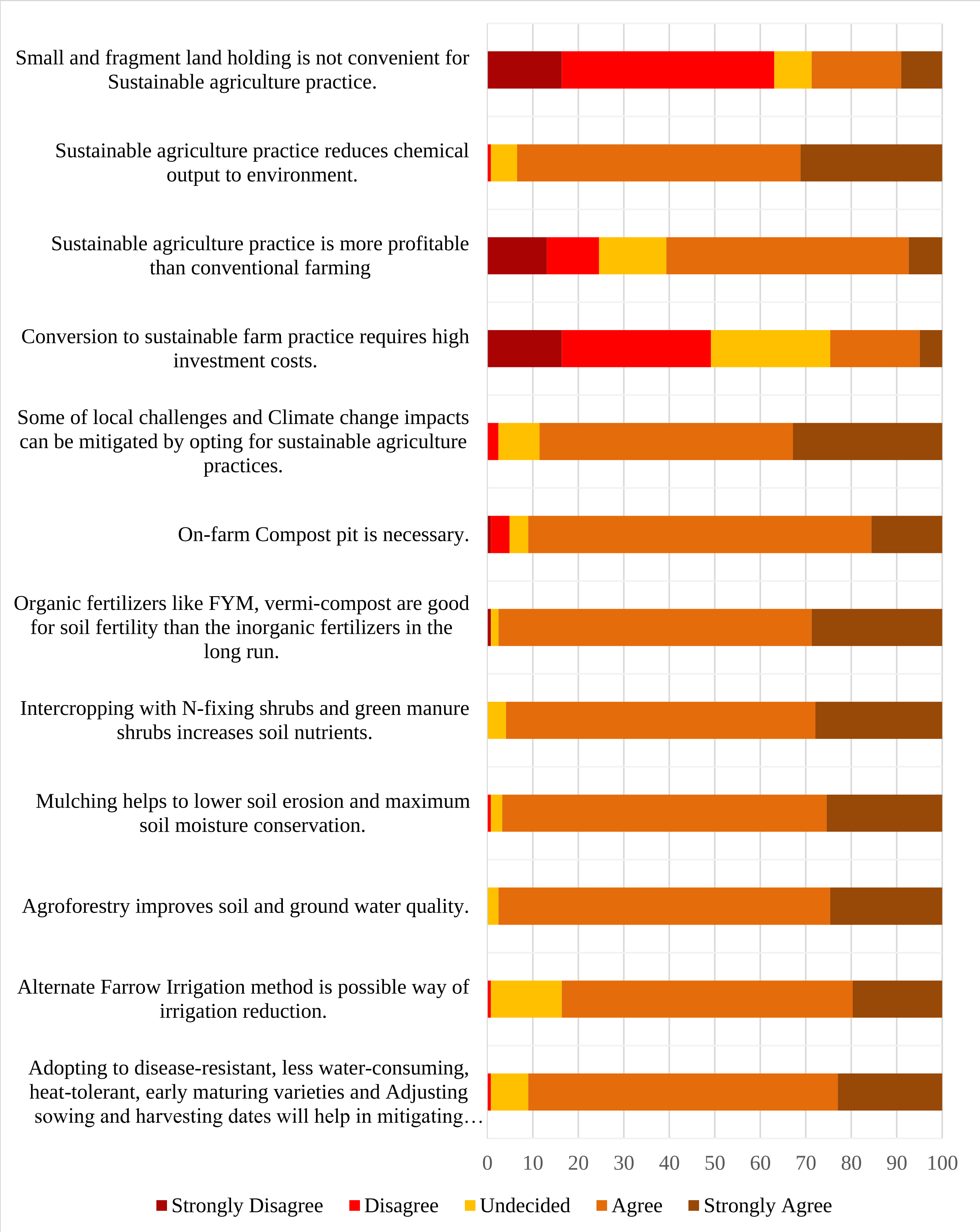

Figure 3: Distribution of response (%) of farmer's general attitude towards Sustainable Agriculture Practices (SAP) in the region.

TPB assessment using PLS-PM measurement & structural model.

Reliability is the assessment of the internal consistency of the constructs. A measure is said to have a high reliability if it produces similar results under same conditions (Hair, J.J.F., *et.al.*, 2014). Cronbach's Alpha is a widely used measure of internal consistency. It assesses how closely related a set of items (questions or indicators) are within a particular construct or scale. The value of Cronbach's Alpha ranges from 0 to 1, where higher values indicate greater internal consistency. In general, a Cronbach's Alpha of 0.70 or higher is considered acceptable for research purposes, as it suggests that the items in a scale are measuring the same underlying construct reliably. Composite reliability is another measure of internal consistency, often used in structural equation modeling (SEM) in SMART-PLS. It assesses how well a set of indicators reliably measures a latent construct. Similar to Cronbach's Alpha, composite reliability values range from 0 to 1, with higher values indicating better internal consistency. Like Cronbach's Alpha, a composite reliability value above 0.70 is generally considered acceptable. Based on the analysis in Table 4, all the indicators used to measure TPB constructs produced reliable and consistent results, as evidenced by Cronbach's Alpha and composite reliability values exceeding the acceptable threshold of 0.70, except for Attitude (Cronbach's alpha = 0.665) which is also acceptable since the current study was exploratory research (Hair, J.J.F., *et.al.*, 2014; Issa, I., & Hamm, U. 2017). Overall, the TPB constructs had good internal consistency, with one construct (Attitude) having a slightly lower but still acceptable level of reliability given the exploratory nature of the study. Reliability assessments like these ensure that the measurements used in the study are consistent and dependable.

Table 4. Reliability tests of TPB measurement model.

latent variable	**Definition**	**Cronbach's alpha**	**Composite reliability (rho_c)**
Con	Adoption of sustainable agriculture practice in the farm within the next five years.	0.859	0.933
BI	Behavioral intention to adopt sustainable agriculture practice in the farm within the next five years.	0.761	0.887
Att	Attitude towards adoption of sustainable agriculture practice in the farm within the next five years.	0.665	0.810
SN	Subjective norms towards adoption of sustainable agriculture practice in the farm within the next five years.	0.797	0.882
PBC	Perceived behavioral control to adopt sustainable agriculture practice in the farm within the next five years.	0.890	0.920
BB (ao*bs)	Behavioral belief regarding adoption of sustainable agriculture practice in the farm within the next five years.	0.787	0.859
CB (am*ns)	Control belief regarding adoption of sustainable agriculture practice in the farm within the next five years.	0.739	0.819
NB (ac*sc)	Normative belief regarding adoption of sustainable agriculture practice in the farm within the next five years.	0.741	0.824
***N*= 125**			

Convergent validity of the PLS-PM is assessed and adjustments were made to improve the quality of the measurement model. This involves removing questionnaire items that had low outer loadings which were not effectively capturing the constructs of interest. The goal was to ensure that the indicators reliably measured the latent constructs, as indicated by Average variance extracted (AVE) values above the threshold of 0.5. In outer loadings most of the indicators were heavily loaded suggests indicators were reliable measures of the constructs under investigation. AVE is the degree to which a latent construct explains the variance of its indicator, in the Table.5 as the average variance of BB and NB variables were < 0.5, questionnaire item which have very low outer loading values was removed to attain a reasonable construct. i.e., BB5 questionnaire item is having very least influence in measuring the behavior belief of the farmers, when removing that questionnaire item, a good set of data is formed which as whole thoroughly measures the behavior belief with 0.604 AVE. similarly, two items (NB3, NB4) items from the data set is removed to get a reliable set of data which will measure the Normative belief thoroughly with 0.54 AVE.

Table 5. Convergent validity test of TPB measurement model.

Questionnaire item <-Latent construct	**Outer loadings**	**Average variance extracted (AVE)**	**Standard deviation**
Con1 <- Con	0.921	0.875	1.280
Con2 <- Con	0.950		
BI1 <- BI	0.836	0.797	1.252
BI2 <- BI	0.947		
A1 <- Att	0.660	0.542	2.230
A2 <- Att	0.892		
A3 <- Att	0.907		
A4 <- Att	0.340		
SN1 <- SN	0.939	0.721	1.578
SN2 <- SN	0.962		
SN3 <- SN	0.596		
PBC1 <- PBC	0.828	0.697	3.021
PBC2 <- PBC	0.751		
PBC3 <- PBC	0.905		
PBC4 <- PBC	0.879		
PBC5 <- PBC	0.802		
BB1 <- BB	0.780	0.604	8.881
BB2 <- BB	0.807		
BB3 <- BB	0.765		
BB4 <- BB	0.757		
CB1 <- CB	0.765	0.548	22.964
CB2 <- CB	0.892		
CB3 <- CB	0.392		
CB4 <- CB	0.812		
NB1 <- NB	0.890	0.544	12.379
NB2 <- NB	0.619		
NB5 <- NB	0.755		
NB6 <- NB	0.657		

Discriminant validity of the measurement model is assessed using the Heterotrait-Monotrait Ratio (HTMT) criterion. It helps to quantify the extent to which variables that are supposed to be measuring different things are indeed distinct from each other. Henseler *et.al.*, (2015) suggested HTMT as the best criterion for discriminant validity. An HTMT value above 0.90 depicts a lack of discriminant validity. Table 6 gives the results of the discriminant validity of the mode. Discriminant validity of the model is successfully demonstrated that the variables used in the study are distinct from each other, as the HTMT values are significantly lower than the threshold value.

Table 6. Discriminant validity test of TPB measurement model. Heterortait- Monotrait Ratio (HTMT).

Latent variables	**Att**	**BB**	**BI**	**CB**	**Con**	**NB**	**PBC**
Att	_	_	_	_	_	_	_
BB	0.475	_	_	_	_	_	_
BI	0.559	0.231	_	_	_	_	_
CB	0.433	0.354	0.307	_	_	_	_
Con	0.743	0.355	0.567	0.356	_	_	_
NB	0.194	0.315	0.151	0.211	0.139	_	_
PBC	0.685	0.364	0.546	0.500	0.844	0.188	_
SN	0.666	0.376	0.369	0.182	0.427	0.105	0.421

The results of PLS-PM of our TPB structural model showed that farmers' positive responses towards the conversion to sustainable agriculture practice. Normative belief and subjective norm played a small role in forming a behavioral intention. Perceived behavior control played a major role in behavior (Conv) in comparison with behavioral intention (Figure 4). It can be said that major ruling factor in forming behavior regarding adaptation of sustainable agriculture practice in the region is control belief and perceived behavior control. Results further indicate that most of the total effect coefficients were highly significant at $p < 0.000$.

Table 7. Total effect coefficients of TPB structural model.

→: Effect Direction (e.g., Attitudes→ Behavior, Represents Effects of Attitudes on Behavior	**Total Effect Coefficient**
Att -> BI	0.217
Att -> Con	0.039
BB -> Att	-0.274
BB -> BI	-0.060
BB -> Con	-0.011
BI -> Con	0.179
CB -> BI	0.150
CB -> Con	0.337
CB -> PBC	0.468
NB -> BI	0.007
NB -> Con	0.001
NB -> SN	0.088
PBC -> BI	0.320
PBC -> Con	0.720
SN -> BI	0.085
SN -> Con	0.015
total effects = direct effects (i.e., path coefficient when there is a direct path connecting two latent variables) + indirect effects (i.e., mediated effects between two latent variables, not necessarily having direct path connecting them). Total effect coefficient is significant at p-value< 0.001.	

Findings are in line with the TPB assumptions, however Behavioral belief has negative influence on the attitude, behavioral intension and conversion (Table 7). That implies that this finding is somewhat counterintuitive, the more positive belief farmers have on sustainable agriculture practice, more was their negative attitude towards adopting to sustainable agriculture practice within the next five years. It suggests that, for some reason, farmers with more positive beliefs about sustainable agriculture practices are showing a negative attitude, weaker behavioral intention, and reduced conversion toward adopting these practices. While TPB suggests that positive beliefs should lead to positive attitudes and intentions, the findings suggest a negative relationship between 'Behavioral belief" and attitude, intention, and conversion regarding sustainable agriculture practices among farmers. On average, even though majority of farmers (91.48%) deemed that outcomes of sustainable agriculture practice is important and not risky to convert, only 47.2% of the farmers didn't want to play it safe and were not 'OK' with current situation and wanted to practice sustainable agriculture in their land (BB1, BB2, BB3, BB4, BB5).

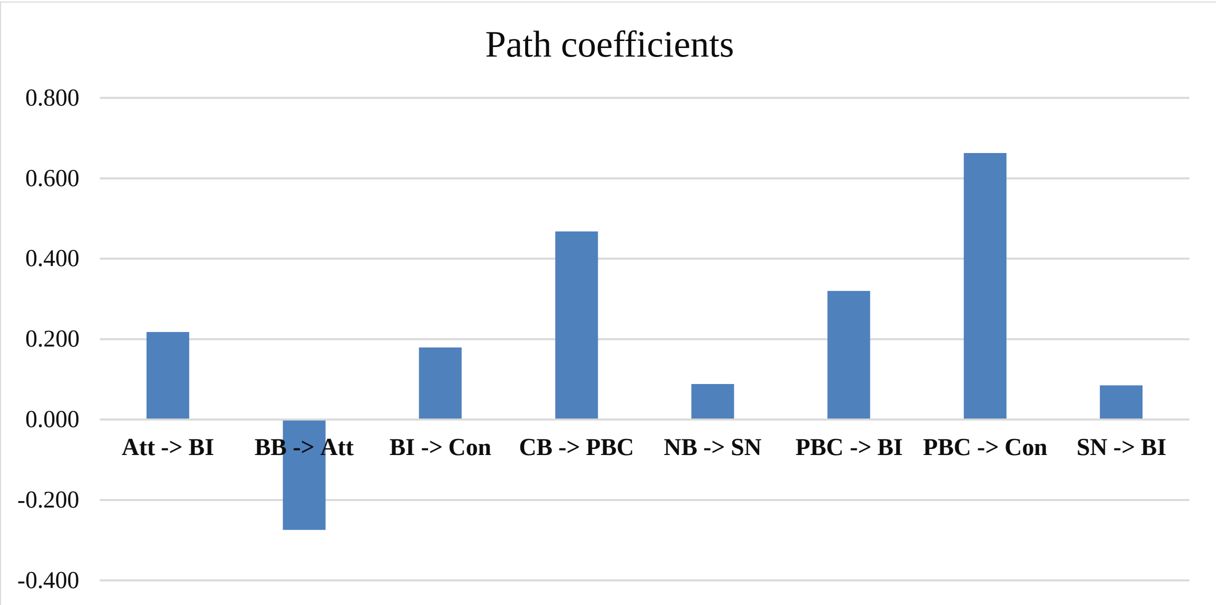

Figure 4. Path coefficients of TPB structural model.

R^2 statistics explains the variance in the dependent variable explained by the independent variable(s). f^2 is the change in R^2 when an independent variable is removed from the model. Cohen (1988) suggested R^2 values for endogenous latent variables are assessed as follows: 0.26 (substantial), 0.13 (moderate), 0.02 (weak) and f^2 is effect size >=0.02 (small); >= 0.15 (medium);>= 0.35 (large). Table 8 shows predictive accuracy and relevance of structural model. R^2 value of the dependent variables behavior intention (BI) and behavior (Conv) are substantially influenced by independent variables (attitude, subjective norm, perceived behavioral control) and (behavior intention, perceived behavioral control) respectively. The influence of behavioral beliefs on the formation of farmers' attitudes was found to be relatively modest. Similarly, attitudes were found to have a limited impact on shaping behavioral intentions, and behavioral intentions, in turn, had a marginal effect on the actual behavior of farmers. In contrast, normative beliefs exhibited a very minimal influence on the development of subjective norms, and these subjective norms had a relatively weak impact on behavioral intentions. The influence of control beliefs on the formation of perceived behavior control was moderate. Even though, Perceived behavior control, had a relatively small effect on behavioral intentions, it is noteworthy that perceived behavior control emerged as a significant determinant, independently exerting a substantial impact on behavior formation, with an effect size (f^2) of 0.812.

Table 8. Predictive accuracy of TPB structural model.

→: Effect Direction	f-square	Effect size	R-square	Effect size
BB -> Att	0.081	Small	0.075	Weak
CB -> PBC	0.280	Medium	0.219	Moderate
NB -> SN	0.008	very small	0.008	Weak
Att -> BI	0.041	Small	0.272	Substantial
PBC -> BI	0.083	Small		
SN -> BI	0.008	very small		
BI -> Con	0.059	Small	0.586	Substantial
PBC -> Con	0.812	Large		

To further understand the behavior of farmers, (homoscedastic, 1-tailed distribution) t-test is performed for all the TPB construct and the t-test p-value is found greater than 0.05 except for the attitude and PBC. this signify that the small, medium and large farmers are significantly acting as different sample groups. when correlation is drawn for Attitude and PBC among the three-population groups, a weak linear correlation is established ($r < 0.4$). Responses for TPB variables among small farmers, medium farmers and large farmers and whole sample size were averaged and are compared with scale ranges (minimum, midpoint, maximum) (Table.9). All the variables received positive responses among all the groups. Intension to adopt sustainable agriculture practice is evenly distributed among the three-groups, when compared with behavior (conversion), a significant negative and strong correlation is formed ($r = -1$, p-value= 0.000) implying the significant decline in behavior compared to intension.

Table 9. Distribution of responses (average) among small, medium, large farmers and whole sample.

Latent variables	**Small farmers *n*=45**	**Medium farmers *n*=40**	**Large farmers *n*=40**	**Sample *N*=125**	**Scale ranges**
BB	59.09	57.65	60.55	59.10	(4) (36) (100)
NB	41.87	42.68	45.55	57.27	(4) (36) (100)
CB	54.78	58.03	59.33	43.30	(4) (36) (100)
Att	12.60	13.30	13.65	13.16	(4) (12) (20)
SN	11.89	11.85	11.90	11.88	(3) (9) (15)
PBC	17.91	19.13	19.28	18.74	(5) (15) (25)
Intension	7.73	7.73	7.73	7.73	(2) (6) (10)
Behavior	7.16	7.45	7.45	7.34	(2) (6) (10)

CONCLUSION

In conclusion, this research paper applied the Theory of Planned Behavior (TPB) to explore the factors influencing farmers' intentions and behaviors to adopt sustainable agriculture practices in the Vrishabhavathi River basin. The study focused on a region facing the dual challenges of urbanization and climate change, which have significant implications for agriculture and food security.

The research found that farmers in the Vrishabhavathi River basin generally have a positive attitude toward sustainable agriculture practices, but this attitude does not always translate into strong intentions to adopt these practices. Interestingly, there was a counterintuitive negative relationship between farmers' beliefs about sustainable agriculture and their attitudes, intentions, and actual adoption of these practices. While many farmers recognized the importance and benefits of sustainable agriculture, a significant portion remained hesitant or resistant to change.

The analysis revealed that perceived behavioral control played a crucial role in shaping farmers' intentions and behaviors. Farmers who felt more in control of their ability to adopt sustainable practices were more likely to intend to do so and, ultimately, act. Normative beliefs and subjective norms had relatively weaker influences on behavioral intentions, indicating that social pressure and perceived social norms were not the primary drivers of farmers' decisions in this context.

Furthermore, the findings suggest that while there is a positive disposition toward sustainable agriculture practices, various factors, including financial considerations and uncertainties, may be inhibiting the translation of intention into behavior. This highlights the need for targeted interventions and policies to address these barriers and provide farmers with the necessary resources and support to facilitate the adoption of sustainable practices.

In light of these results, policymakers and agricultural stakeholders should focus on enhancing farmers' perceived behavioral control by providing them with the tools, training, and resources needed to transition to sustainable agriculture. Additionally, efforts to raise awareness and educate farmers about the long-term benefits of sustainable practices could help bridge the gap between positive attitudes and actual adoption.

Current study has several limitations, the study focused on certain sustainable agriculture practices within 5km radius of the river basin and in single time frame. The study will not represent farmers who are not relaying on stream water for agriculture practices. The study has not captured the influence of seasonal variations in sustainable agriculture adoption. The study only talks about adaptation of certain sustainable agriculture practices and does not represent all sustainable practices. Since there is significant group formation within the sample (small, medium, large farmers) current sample size limits sample replication to represent entire population.

Overall, this study contributes valuable insights into the complex decision-making processes of farmers in the Vrishabhavathi River basin and underscores the importance of considering psychological and behavioral factors in the promotion of sustainable agriculture practices. Addressing these factors can play a pivotal role in building resilience and sustainability in agriculture, which is crucial for the region's economic, social, and environmental well-being in the face of evolving challenges.

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