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## RESEARCH ARTICLE

### Analysis of Contributing Factors Enhancing Rural Transportation System: A Case Study of South-Eastern Provinces of Vietnam

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#### Abstract:

##### Background:

Under-developed countries like Vietnam are facing sustainability problems in developing transportation infrastructure for rural and remote areas. The lack of financial resources and public support is the causative factor of the problem. Rural community participation is considered crucial to resolving these problems. Even demographics strongly influenced, but how they should interact with community participation is still under study in the South-eastern provinces of Vietnam.

##### Methods:

South-eastern provinces of Vietnam, including HoChiMinh City and BaRia-VungTau, BinhDuong, BinhPhuoc, DongNai and TayNinh provinces, were selected for the study due to the high requirement of rural transportation infrastructure in these provinces. Questionnaires were sent to local households for data collection. Data analysis was conducted descriptively with the model of logistic regression.

##### Results:

Community participation is identified as contributions in terms of finance, labor, material, and land. Household composition, education, income, and a member in the household as a community leader are among the chief contributing factors to community participation.

##### Conclusion:

The study can be beneficial for policymakers and local governors in planning and predicting local rural development programs. It aims to enhance rural community participation and increase rural transportation infrastructure in the South-eastern provinces of Vietnam.

**Keywords:** Community participation, South-eastern provinces, Infrastructure, Rural, Transportation, Vietnam.

#### Article History

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## 1. INTRODUCTION

From 2010 to 2020, Vietnam has newly built, renovated, upgraded and maintained, and repaired 345,897 km of roads, 31,364 bridges, and 125,639 culverts, thereby increasing the rate of hardening of rural roads from 37.9% in 2010 to 69.15% in 2020. The conference that summarized 10 years of rural transport development to implement the National Target Program on New Rural Development 2010-2020 [1] has paid special attention to development. A rural transport system with the participation of the community people is important. In principle, construction projects for the community must ensure

the participation of people in terms of management and supervision, project planning, implementation, organization, monitoring, and evaluation of completed works and their benefits. However, the policy mechanism and participation model still have several inadequacies. Lack of democracy and transparency, limited participation of people, and management skills not meeting the requirements of continuous development lead to many mistakes. The lack of management of participation of people and infrastructure construction for rural transport in localities causes suspicions in the community, people, and even cases of complaints, and complaints causing loss of Community solidarity [2]. Until 2030, Vietnam would need about 150-160 billion USD for investment in infrastructure development and improvement in various sectors such that 40 billion would be required for electricity, 53 billion

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for land roads, 3 billion for the railway, and 25 billion for ports [3]. It will require a capital of about 15-16 billion USD every year. The current national capital resources, including government budget capital, Official Development Assistance (ODA), and bonds, can meet only about 50% of this investment demand [4]. Since the government cannot afford to build infrastructure for all levels due to insufficient resources, the participation of all other stakeholders is inevitable.

Contrary to national and urban infrastructure systems, rural infrastructure serves the community in that rural area only. The participation of the community is therefore essential as it ensures sustainability [5]. To mobilize community participation in rural infrastructure development, erroneous and incomplete infrastructure should be avoided. Theoretical and practical bases are first necessary to be studied for proposing suitable solutions and policies. Policymakers and local governments in Vietnam are facing problems in planning successful investment in rural transport infrastructure and predicting outcomes of current developing programs since these actions require much and in-depth knowledge of the country's current and future resources, local demands, and socio-economic attitudes toward the programs [6, 7].

This study aims to explore the current status of community participation through a case study in the South-eastern provinces of Vietnam (Fig. 1) as a typical Mekong delta zone that urgently needs a rural transportation infrastructure. The second purpose of the study is to examine the relationships between demographic characteristics and community participation itself. Since demographic and socio-economic trends and community concerns are the most important factors that affect transportation planning [8], the results of this study

can help policymakers and governments in solving the tandem conundrums involved in developing rural transport infrastructure.

## 2. LITERATURE REVIEW

### 2.1. Community Participation as a Driver for Rural Infrastructure Development

Community participation (or public participation) is defined by the Mid-America Regional Council (MARC) as *“Public participation is based on the belief that people whose lives are affected by transportation planning and investment decisions have a right to be involved in the decision-making process and influence choices that are made. Directly engaging citizens in this process promotes successful problem solving, yields diverse voices and new ideas, and gives the public a sense of ownership of the developed solutions”* [9].

Less formally, community participation is referred to as *“the social process of taking part (voluntarily) in formal or informal activities, programs and/or discussions to bring about a planned change or improvement in community life, services and/or resources”* [10]. Therefore, volunteerism is a crucial part of the community participation concept. Through community, individuals in communities can maximize their potential and progress from individual action to collective social and political change [11]. Community participation adds many benefits to project development in general [12]. Community participation in rural transport infrastructure development has been studied by scholars worldwide [13, 14]. The authors agreed on the need for this force, especially in developing countries.

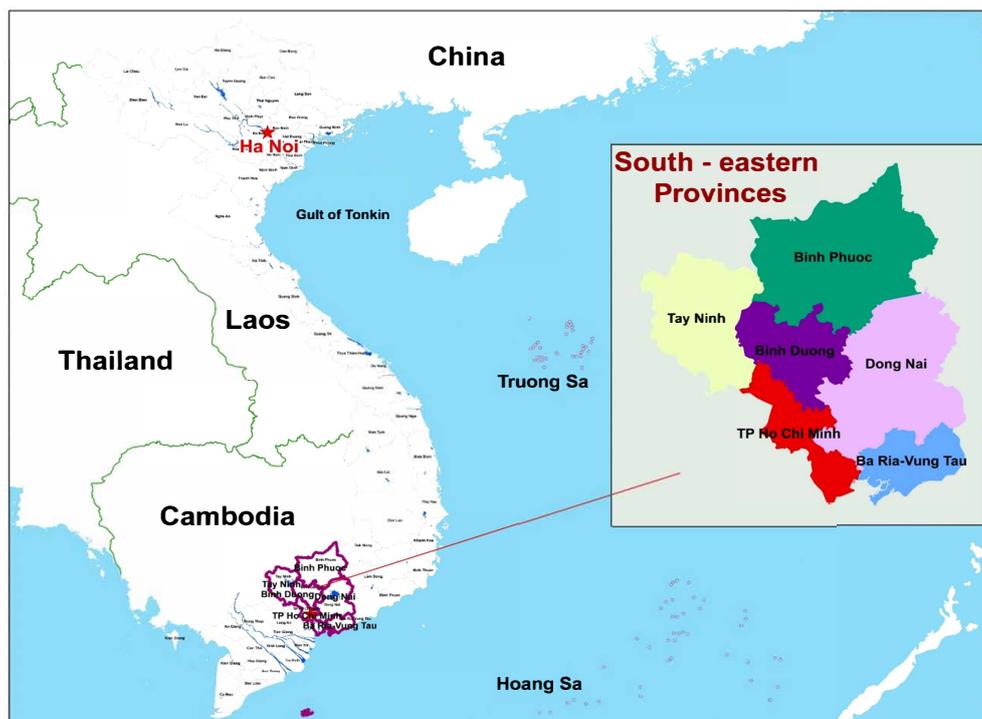


Fig. (1). Maps of the South-eastern Provinces of Vietnam.

The process of developing rural transportation infrastructure is complex and long-term, with many phases involving the community such as to: define demands, estimate costs and participate in policies, contribute to physical resources (money, labor, materials, and land) and site construction, supervise and audit, manage and maintain, utilize, and evaluate the infrastructure projects. Among these, physical contributions are commonly indicated by several researchers [6, 15, 16]. Understanding what leads to higher community participation well equips policymakers in planning, developing, and managing infrastructure projects; therefore, this topic has been the focus of literature.

## 2.2. Effects of Socio-Economic and other Demographic Characteristics on Community Participation

Shye (2009) [17] categorized causes of community participation into three groups: demographic antecedents (personal resources and assets needed for participants), motivations (why participants want to contribute), and circumstances (the context which facilitates and prompts volunteering). The same idea on the cause of motivations was addressed by Pho (2008) [18] stating that participants would feel better by either mentally or financially volunteering. Carpenter and Myers (2010) [19] stated that participating in community activities is “a way of ensuring the provision of a public good, as a means of investing in human capital, as a means of gaining other extrinsic rewards, and as a manifestation of underlying tastes and attributes such as extroversion, altruism, or a desire to look ‘good’ to others”.

In attempts to synthesize determinants of community participation, Smith (1994) [20] determined six variable groups: contextual variables (community and regional influences), social background variables (age, gender, household composition, health, income, occupational prestige, and education), personality variables (efficacy – an internal locus of control, empathy, morality, emotion, self-esteem or ego strength), attitudinal variables (attitudes of individuals that may come from perceived benefits, cost of participation), situational variables (symbolic interaction between one individual and others), and social participation variables (how an individual participates in such societal discretionary time activities as friendship, politics, associations, church, neighboring, outdoor recreation, and mass media activity).

These determinants were also reported in the work of Martinez and McMullin (2004) [21], where causes of volunteering in community activities were: efficacy (able to help), competing commitments (benefits to participants), social network (surrounding by other participants), lifestyle changes (demographics), and personal growth. Among the determinants of community participation, demographic characteristics are mostly focused in the literature. Table 1 presents demographic characteristics as identified by scholars.

For the scope of this study (the Southern provinces of Vietnam), ethnicity and religion are irrelevant. Therefore, ten demographic characteristics are selected as variables to influence community participation in rural transport infrastructure development, including age, gender (male/female), occupational training, education, household labor

force, household income, household income per capita, farm-work income, member(s) in the household as community leaderships, and the terrain of living area.

**Table 1. Demographic characteristics that impact community participation.**

Works	Demographic Characteristics
Smith (1994) [20]	Age, gender, household composition, health, income, occupational prestige, and education
Segal and Weisbrod (2002) [22]	Age, gender, ethnicity, education, income, household composition, health, and religion
Obst and Smith (2002) [23]	Age, gender, region, length of residency, residency status, number of children, income, education, local organization member, and view of the neighborhood
Lammers (1991) [8]	Age, gender, marital status, skill acquisition, income, education, previous experience, and rural background
Pho (2008) [18]	Age, gender, marital status, number of children, ethnicity, income, occupation, education, labor force status, region, region, goods industry, and sector industry
Van Ingen and Dekker (2010) [24]	Age, gender, religion, employment, household composition, and education
Van Overschelde (2017) [25]	Age, gender, race/ethnicity, socio-economic status (income, and education)

## 2.3. The Suitability of Logistic Regression as a Statistical Technique for the Determination of Community Participation Factors

Logistic regression (or binary logistic regression) is a powerful statistical technique to classify objects with dependent variables that have two outcomes, binary or dichotomous [26]. Logistic regression has the same purpose as discriminant analysis, which can classify objects into more than two clusters. However, discriminant analysis requires many more strict assumptions about data [27]. This makes the higher frequency of usage for logistic regression. In this study, we aim to assess the relationships between input factors and community participation, which is presented by Yes/No themes. In many earlier studies in the field of infrastructure development, authors took advantage of logistic regression [28 - 31]. Therefore, logistic regression is an appropriate data analysis method for this study.

## 3. RESEARCH METHODOLOGY

Firstly, the literature reviews were carried out. Therefore, demographic factors that affect community participation were synthesized. Questionnaires were devised and included in surveys sent to local households in the South-eastern provinces of Vietnam.

Data used in this study included officially published secondary data, research projects, and related assessment reports of central ministries, local departments and sectors, and related governmental agencies such as the Ministry of Transport and Communication and the Ministry of Agriculture and Rural Development.

Data obtained from the surveys were analyzed descriptively to reveal a general snapshot of the demographics

in the South-eastern provinces of Vietnam and the current status of community participation. Then, logistic regression was performed to explore the influence levels of demographic factors on community participation in enhancing the transport system.

Results were carefully considered to identify potential directions to improve the effectiveness of transportation planning and to predict the outcomes of considered projects, as well as to enhance participation of the rural community itself in certain circumstances.

#### 4. DATA ANALYSIS AND DISCUSSION

##### 4.1. Status of Participation of Rural Community in Enhancing Transportation Infrastructure in South-eastern Provinces of Vietnam

###### 4.1.1. Results of Building Rural Transportation Infrastructure with the Community Participation in Southeast Provinces of Vietnam

According to the Central Steering Committee of the National Target Program to build a new countryside, nearly 100% of communes in the Southeast have roads to districts and communal roads; 98% of village roads are made of concrete or asphalt. HoChiMinh city and DongNai are important lessons in resource mobilization, which are experiences for other localities to refer. That is, to promptly concretize the local mechanisms and policies on mobilization so that all classes of people can see the role and meaning of the efficient allocation of resource contributions from the people as both the subject and the beneficiary (Khanh Van, 2019) [32].

Focusing on building and perfecting institutions, especially perfecting the system of mechanisms and policies for community management participation in rural transport infrastructure development, is the most important and decisive factor in creating a favorable environment for the mobilization of resources to participate in the development of the transport infrastructure system, at the same time creating a legal basis for management more efficient [33].

###### 4.1.2. Results of Community Management Participation in Enhancing Rural Transportation Infrastructure in South-eastern Provinces of Vietnam

To have an objective assessment of the community participation in rural transport infrastructure development in the study area, the author consulted to survey 438 community representatives (regardless of community type: government, mass organizations, businesses, and people). As a result, all communities were more or less involved, with items of inter-commune rural transport infrastructure 85.8%, inter-village 96.7%, inter-village 98.3%, alleys 95% and other 95.8%, with the closer demand for participation. Management participation in the Southeast province depends on community calling and training. With 438 votes/ 100% of the surveyed communities said that they would participate in management if required and need guidance, training, dissemination, etc. It showed that all types of communities were willing to participate because of the responsibilities and interests of the community itself. The

management of participation in rural transport infrastructure development mainly focuses on revenues and expenditures of contributions, construction, cost estimates, and acceptance of construction projects. However, the level of participation in rural transport infrastructure development in South-eastern provinces sets is uneven. The reason for the uneven degree of participation in this content is due to the limited training, dissemination, and propaganda of the community about this content. Moreover, because the mentality of “responsibility goes hand in hand with interests”, it means that by participating, there is management participation.

###### 4.1.3. Status of Community Participation

Community surveyed 438 households in the locality. 94.70% of households provided information for each type of road, and only 5.30% did not participate. Participation depends on the interests of the community itself and the policy of calling for participation. That is, the community wants to participate only if the community sees the benefits of its participation. At the same time, to improve the effectiveness of participation, it is very important to promote and encourage participation, according to each type of locality.

The community contributed in professional comments. The survey has 67.80% of households involved in contributing ideas for one or more stages (identification of needs and planning, policy development planning, resource contribution, direct construction, inspection, supervision, operation and maintenance, maintenance, and efficiency evaluation). Contributions are mostly voluntary because participants must have a clear understanding of what they are involved in. As a result, 32.20% of the surveyed households did not comment on any of the stages of the rural infrastructure development process, as they thought they were not well aware or were not proficient.

The community participated in policy formulation. Participation in policy formulation includes participation and calling for investment, calling for participation, rights, and responsibilities of organizations, people, and communities in the development and construction of rural transport infrastructure. Policy formulation has long been understood as the work of local authorities, and community organizations.

Community-contributed material values (financial, labor, material, land).

###### 4.1.3.1. Financial Contribution

The Rural Transport Development Program achieved impressive results with funding from all sources of more than \$ 1.4 billion. Most localities focused on many resources, self-allocating budgets for new rural development of about 36,600 billion VND, in which there were more than 2900 billion people who donated and supported. The result showed the high consensus of the people. For rural transport infrastructure and community participation to be guaranteed, the authorities must also have a community participation management mechanism to ensure efficiency, openness, and transparency, strengthening flexible solutions in the organization, management, and monitoring of community participation towards sustainable participation. This is a form of economic contribution, with the

contribution increasing steadily over the years. In 2016, the community contributed 553.05 billion VND to the development of 1268.55 km of rural transport infrastructure. In 2017, the total mobilized capital was VND 973.83 billion (an increase of 76.08% compared to 2016) for 1716.00 km. In 2018, it was 1394.62 billion VND (an increase of 43.2% compared to 2017) for 2163.45 km. In 2019, it was VND 1784.49 billion (up 28% compared to 2018) for 1717.95 km, and the plan for 2020 calls for contributions of VND 2194.01 billion for 2268.00 km. Not to mention that the people voluntarily contributing to the repair and development of rural transport are not spontaneous statistics and local organizations and communities do not report.

**4.1.3.2. Labor and Material Contribution**

Most development of rural traffic infrastructure involves public work, especially planning and construction. The contribution of the communal day is high due to the socialist model of the socialist period, with common characteristics, shared meals, and is considered a good image of the spirit of family unity. At present, types of material contributions are

also common, especially where materials are available such as cement, sand, gravel, and bricks.

**4.1.3.3. Land Contribution**

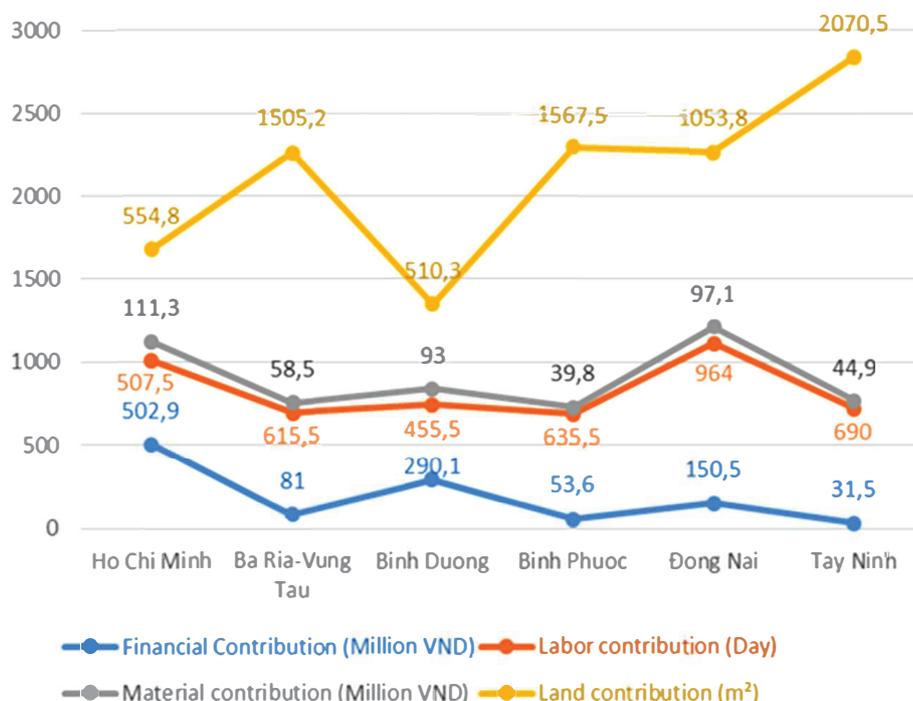
With the current Land Law of Vietnam, participation may be voluntary (land donation) and exchange (compensation). Therefore, issues such as complaints, grievances, disputes, and corruption or slow progress are common in the process of building and developing rural transport infrastructures in general. In summary, in the process of contributing to the development of rural infrastructure, the contribution of the community is not limited in terms of forms of participation. The practice of calling for participation should be flexible for all forms of participation to enable the community to choose their appropriate ways of participation and, maximize the involvement of the community.

**4.2. Assess Levels of Participation**

The survey of 438 households in the study area is shown in Table 2 and Figs. (2, 3 and 4) as follows:

**Table 2. The number of community participation.**

Targets	Ho Chi Minh	Ba Ria-Vung Tau	Binh Duong	Binh Phuoc	Dong Nai	Tay Ninh	Total
Survey number (Individual)	103	61	68	59	90	57	438
Participation number (Individual)	103	61	68	58	89	56	435
Financial Contribution (Individual)	103	45	65	38	80	26	357
Labor contribution (Individual)	72	58	55	58	89	56	388
Material contribution (Individual)	49	51	65	42	85	50	342
Land contribution (Individual)	15	21	18	25	23	30	132



**Fig. (2).** The results of community participation.

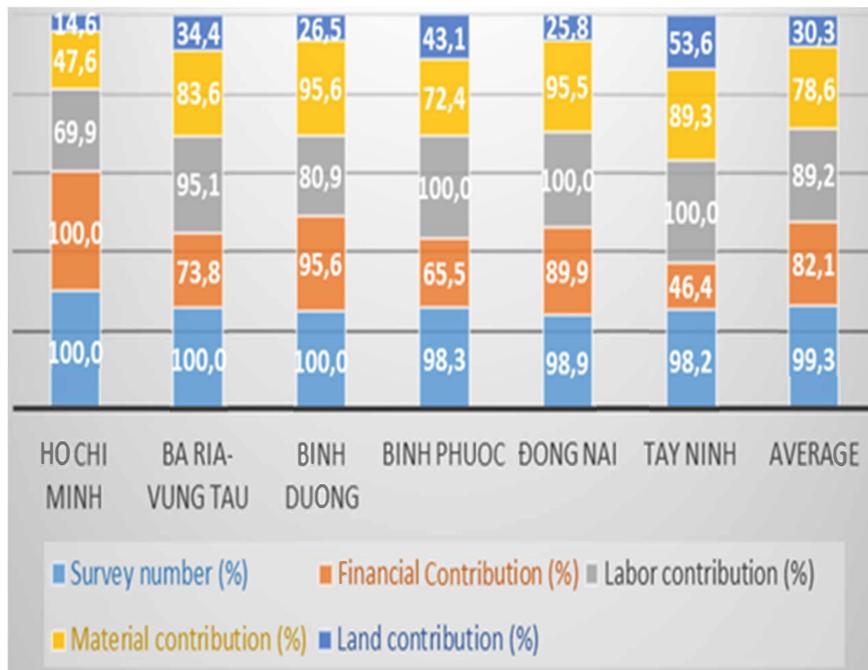


Fig. (3). The rate of community participation.

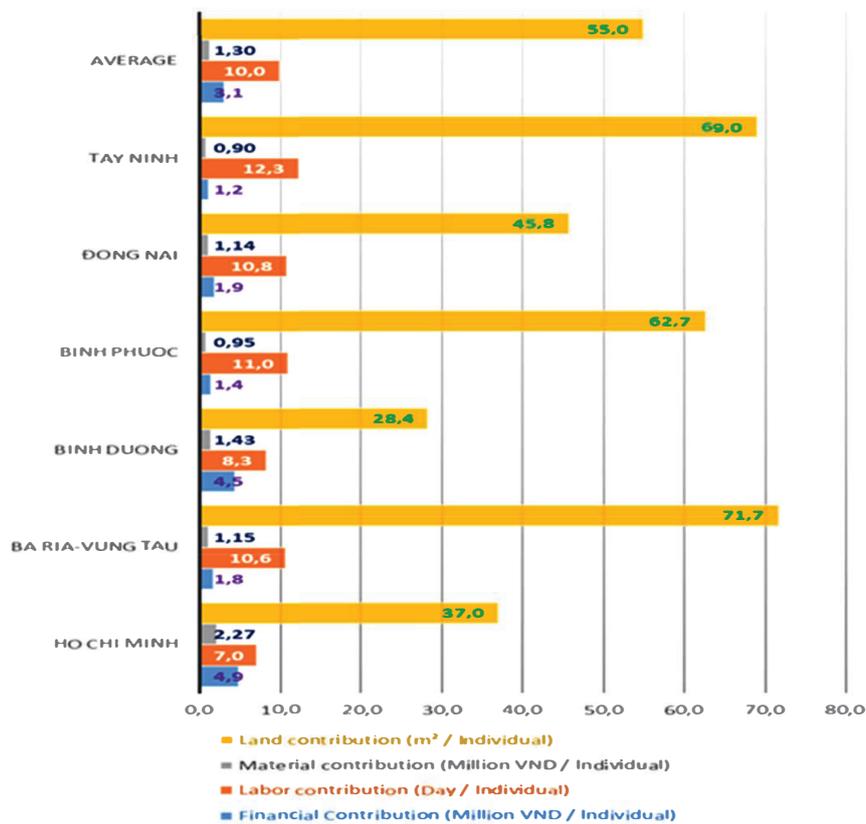


Fig. (4). The results of the community of individual participation.

4.2.1. Financial Contribution

356 households (82.10% of surveyed households) contributed 1,109.6 million VND, of which the HoChiMinh City stands at the top with 103 households (100%), contributing 502.9 million VND; Binh Duong with 65

households (95.60%) contributed VND 290.1 million; DongNai with 80 households (89.9%) contributed 150.5 million VND; Baria-VungTau with 45 households (73.8%) contributed 81 million VND, BinhPhuoc with 38 households (65.5%) contributed 53.6 million VND and TayNinh with 26

households (46.4%) contributed 31.5 million. The proportion of contributions in cash to rural infrastructure development was quite high. A locality with high efficiency means a locality with good economic conditions that encourages public and transparent participation.

#### 4.2.2. Labor Contribution

388 households participated (89.20% of surveyed households), consisting of 3,868 people, of which three localities participated 100%; DongNai contributed 964 working days, Tay Ninh contributed 690 workers and BinhPhuoc contributed 635.50 workers; Ba Ria-VungTau with 58 households (95.1%) contributed 615.5 workers; Binh Duong with 55 households (80.9%) contributed 455.5 workers, and HoChiMinh city with 72 households (69.9%) contributed 507.5 working days. As a result, the sense of community in the locality appeared good, concluding that, “There are no conditions for contributing money to work day”. Typically, Tay Ninh had the lowest financial contribution rate (46.4%), but labor contribution was 100%, with the highest rate of workdays per worker at 12.1 days/individual.

#### 4.2.3. Material Contribution

342 households (accounting for 78.8% of surveyed households) contributed material for the construction of RTs equivalent to 444.6 million VND, of which 85 households from DongNai contributed (95.5%) the main material such as soil, paving stone, cement, and embankment worth 97.1 million VND; Binh Duong with 65 households (95.6%) and BinhPhuoc 42 households (72.4%) contributed sand and stone for the road worth 93 million VND and 39.8 million VND, respectively; Tay Ninh with 50 households (89.3%) contributed mainly stone, soil and broken bricks, and paving stones, worth 44.9 million; Ba Ria-VungTau with 51 households (83.6%) contributed broken bricks and paving stones worth 51.0 million; and HoChiMinh city also actively contributed with 47.6% of households contributing the possible materials with a value of VND 111.3 million. The participation rate of this type of contribution was quite low due to the different conditions of participation of households in the community and the locality difference.

#### 4.2.4. Land Contribution

132 households participated (accounting for 55.0% of the surveyed households), contributing 7262.1 square meters of land, of which TayNinh had the highest share of 30 households (53.6%), contributing 2070.5 m<sup>2</sup>; BinhPhuoc had 25 households (43.1%), contributing 1567.5 m<sup>2</sup>; Ba Ria-VungTau had 21 households, contributing 1505.2 m<sup>2</sup>; Binh Duong had 18 households (26.5%), contributing 501.3m<sup>2</sup>, DongNai had 23 households (25.8%), contributing 1053.8 m<sup>2</sup>, and HoChiMinh city had 15 households (14.6%), contributing 554.8 m<sup>2</sup>. The contribution/donation of land for rural infrastructure development was significant, depending on the needs of rural infrastructure development and advocacy.

### 4.3. Analysis of Demographic Factors Affecting Community Participation

The model of Binary Logistic Regression is often given as Equation 1 [34] below:

$$\text{Ln} \left[ \frac{P(Y_j = 1)}{P(Y_j = 0)} \right] = \beta_0 + \sum_{i=1}^n \beta_i X_i \quad (1)$$

where  $P(Y_i=1)$  is the odds that the community is involved,  $P(Y_i=0)$  is the odds of not participating, and  $\beta$  ( $0, i = 1..n$ ) are the coefficients. The independent variables  $X_i$  are defined with convention as follows:

- $X_1$  - age
- $X_2$  - gender (male/ female)
- $X_3$  - professional training (certificate, 2-year college, 3-year college, university, postgraduate)
- $X_4$  - level of education (primary school, secondary school, high school)
- $X_5$  – the number that can provide a workforce in the household
- $X_6$  – income class (poor, lower-income, middle income, higher income)
- $X_7$  – member(s) in the household as community leaderships
- $X_8$  - average income per capita in the household
- $X_9$  - the proportion of income from farmwork
- $X_{10}$  - the terrain of a living area (mountainous, hilly, plain, others)

The data were analyzed in IBM SPSS 25 [35]. As the first step of any regression procedure, data screening - collinearity check – was performed for the variables (Fig. 5).

The scatter plot in Fig. (1) shows some correlation between some pairs of variables such as income per capita – education level, and income per capita – training level, which are reasonable and predictable. The remaining variables do not appear to form any curvilinear patterns, implying high robustness when applying logistic regression.

#### 4.3.1. Results of Analysis

Table 3 depicts the results of the analysis, where in:

- $X_i$  - input variables as defined in the legends of Equation (1).
- Y1 – financial contribution
- Y2 – labor contribution
- Y3 – material contribution
- Y4 – land contribution

Table 3. Results of the analysis.

Output	Intercept	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
Y1	2.975	0.015	-0.184	0.075	0.125	-0.128	0.425	-0.061	0.037	0.023	-0.051
Y2	0.122	0.115	-0.367	-3.573	1.071	-0.145	-0.962	7.424	0.159	-0.029	-0.577
Y3	0.480	0.003	-0.265	0.507	-0.350	0.022	-0.198	0.057	0.006	0.004	0.340
Y4	2.314	0.002	-0.394	-0.046	0.071	0.017	-0.103	0.795	0.017	0.018	0.220

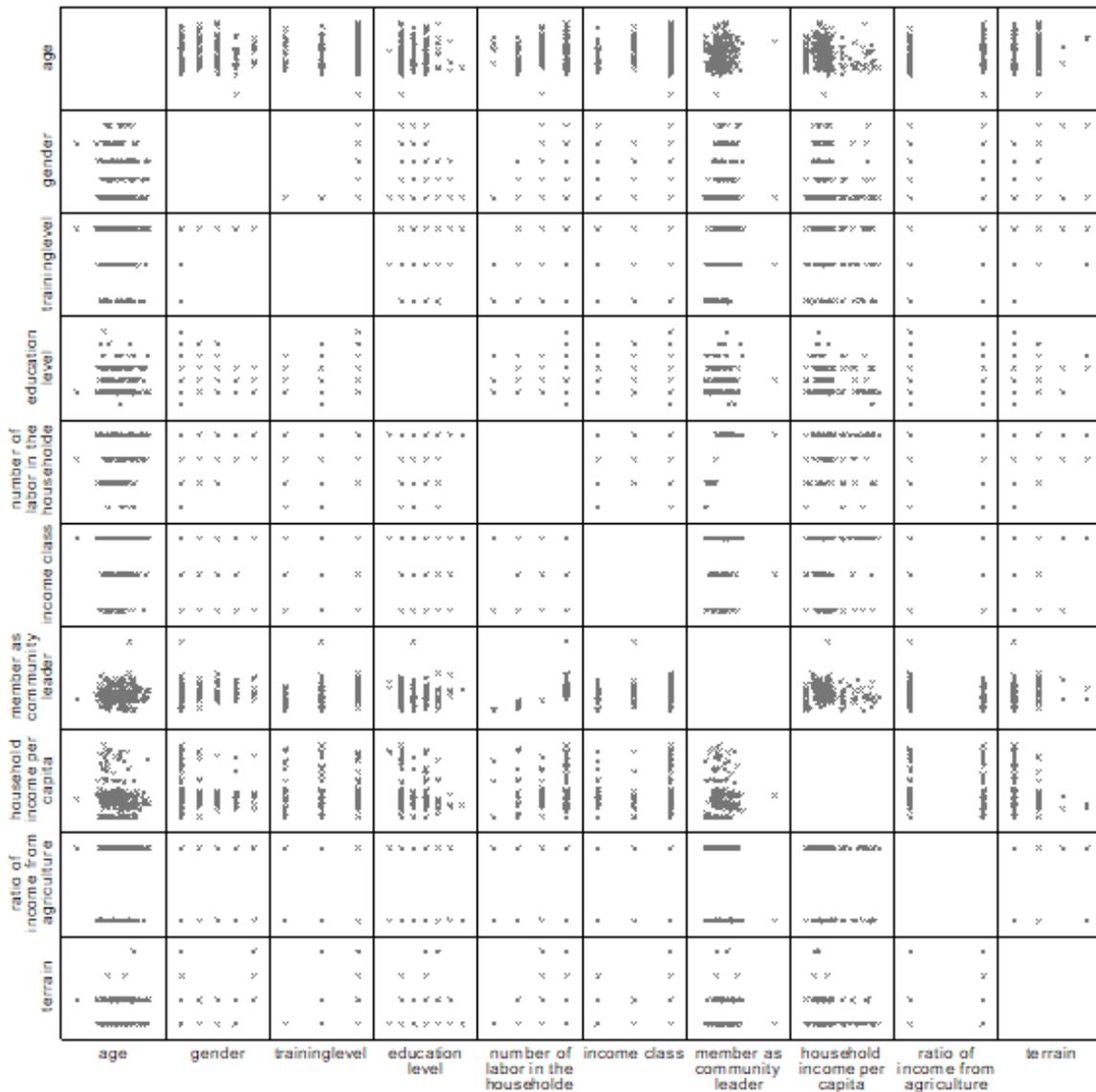


Fig. (5). Collinearity check of ten variables.

4.3.2. Financial Contribution

In the test,  $P(Y_1=1)$  is the probability of the financial contribution of the community;  $P(Y_1=0)$  is the probability otherwise. Table 4 shows the statistics of the test of financial contribution. Tabular statistics of other tests (labor contribution, material contribution, and land contribution) are omitted for the sake of the scope of the paper; however, those values are discussed. Regression analysis is based on the

significance level (Sig.) The Wald test shows that: from  $X_1$  to  $X_5$  and  $X_7$ , there is Sig. all  $> 0.05$ . Therefore, the correlation coefficients are not significant for the  $Y_1$  variable, with a 95% confidence interval;  $X_6$  has Sig.  $< 0.1$ . Therefore, the correlation coefficients are significant for the  $Y_1$  variable, with a reliability of 90%; the variables  $X_8$  and  $X_9$  have Sig  $< 0.01$ , indicating that the correlation coefficient is significant for  $Y_1$ , with a reliability of 99%.

**Table 4. Variables in predicting Yes/No for the financial contribution.**

Model		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 <sup>a</sup> Constant	x1	0.015	0.014	1.180	1	0.277	1.015
	x2	-0.184	0.297	0.383	1	0.536	0.832
	x3	0.075	0.206	0.131	1	0.718	1.077
	x4	0.125	0.297	0.177	1	0.674	1.133
	x5	-0.128	0.121	1.128	1	0.288	0.880
	x6	0.425	0.245	3.012	1	0.083	1.530
	x7	-0.061	0.405	0.023	1	0.881	0.941
	x8	-0.037	0.014	6.874	1	0.009	0.964
	x9	0.023	0.008	8.281	1	0.004	1.024
	x10	-0.051	0.204	0.062	1	0.803	0.950
			2.975	1.277	5.428	1	0.020

a. Variables in step 1: x1, x2, x3, x4, x5, x6, x7, x8, x9, x10.

Validation of the model: with 435 participants, the model predicted 434 or 99.7% participants. Hence, the correct forecasting rate of the whole model is 85.6% (Table 5).

**Table 5. Classification table.**

-	Observed data		Prediction		
			Communities have contributed money		The exact percentage
			No	Yes	
Step 1	Communities have contributed money	No	0	3	.0
		Yes	1	434	99.7
	Common rate		-	-	85.6

Omnibus testing shows Sig. <0.05 (95% confidence). Thus, independent variables are related, as shown in Table 6.

**Table 6. Omnibus test modeling factors.**

Model		Chi-square	df	Sig.
Step 1	Step	18.519	10	.047
	Sector	18.519	10	.047
	Model	18.519	10	.047

As a result of the analysis, the average income, income from agriculture, and household economy appear to have a direct impact on the contribution of community money to rural infrastructure development. Specifically, up to 42.50% of households decide to donate money for every 100 households and increase their income (from poor to near-poor households / from near-poor to middle-income households / from middle income to good income households) to one million VND. The average household income and 1.00% increase in the household income from agriculture will increase by 3.70% and 2.30%, respectively, due to community contribution to rural infrastructure development. Thus, the household economy has the greatest impact on the decision to contribute because if the household income is relatively higher, the contribution will be good; and if the economy of households is good, the demand for participation will be higher. This is a matter of concern when mobilizing the community to contribute their money.

**4.3.3. Labor Contribution**

In the test,  $P(Y_2=1)$  is the probability of the community to

contribute labor,  $P(Y_2=0)$  is the probability otherwise. Regression testing based on the significance level (Sig.) of the Wald test shows that: X1, X2, X4-X6, and X8-X10 have Sig. all > 0.05. Therefore, the correlation coefficients are not significant for the Y2 variable, with a reliability of 95.0%. X7 has Sig. = 0.012 <0.02. Therefore, the correlation variable is significant for Y2, and the reliability is 98%. The variable X3 has Sig <0.01. The correlation coefficients are significant for Y2, with a confidence level of 99%. Validation of the model: with 388 households participating, the model predicted 388 correct results, so the accuracy rate is 100%. The remaining 50 households did not participate, but the model predicted 47 households, so the accuracy rate is 94.0%. The predicted accuracy rate of the whole model is 99.1%; Omnibus inspections show Sig. < 0.01 (99% confidence). Thus, independent variables have linear relationships with dependent variables in the aggregate. The model selection is appropriate.

In conclusion, having family members working as a community leader in households greatly affects the contribution of labor, with the rate of every worker having a cadre of staff to contribute at least 7.00 working days for the development of rural transport infrastructure. Rural transportation infrastructure often staffed by staff members is more likely to be involved in and advocate for “role models”. This can be considered as a solution in the promotion of community participation.

The professional qualification of the head of household has an impact on the total number of working days, contributing equally to 3.57 unskilled laborers per working day. However, the use of skilled workers should be planned, surveyed for appropriate use to effectively engage in because of the need for manual/non-professional work and vice versa.

**4.3.4. Material Contribution**

In the test,  $P(Y_3=1)$  is the probability of community contributing material;  $P(Y_3=0)$  is probability otherwise. Regression testing based on the significance level (Sig.) of the Wald test shows that: X1, X2, and X4-X9 have Sig. > 0.05. Therefore, the correlation variable Y3 does not make sense, with 95% confidence; X10 has Sig. = 0.017 <0.02. Therefore, the variables are significant for the Y3 variable, with 98% confidence; variable X3 has Sig = 0.002 <0.01, indicating that

the correlative variables are significant for variable Y3, with 99% confidence. Validation of the model: with 342 households participating, the model predicted exactly 324 households, so the correct rate is 94.70%. Ninety-six households did not participate, but the model predicted 93 households; the accuracy rate is 96.9%. Therefore, the predicted correct rate of the whole model is 95.8%; Omnibus Test Sig. = 0.002 < 0.01 (99% confidence). Thus, independent variables have linear relationships with dependent variables in the aggregate. The model selection is appropriate.

The results of the analysis indicate that the level of expertise of the community has a high impact on the contribution of materials, with a predicted level of 1 that will contribute more valuable material than level 0, with VND 51 million per household compared to non-qualified persons. It is argued that those with higher levels of competence are more capable and conscious of contributing. They often suggest different forms of participation when they are not able to participate in forms of work they like to do. They are unavailable if they have no land near the road to donate.

The site / natural conditions are the conditions that stimulate the community to contribute material, with the level of one household having material conditions in place which tend to contribute material with a value higher than 1.37 million VND / household compared to people without conditions. Thus, the contribution of material depends on the condition, the availability of the community, and or the ability to mobilize the material.

The contribution of material is not only dependent on the economic condition of the household, but also on the specific characteristics of the rural economy. The motto “what contributes” is considered as a breakthrough solution in enhancing the participation of rural communities in rural infrastructure development. This solution encourages many people to participate and limits the difficulties of the People's Council, creating fairness in participation.

#### 4.3.5. Land Contribution

In the test,  $P(Y_4=1)$  is the probability of community land donation,  $P(Y_4=0)$  is probability otherwise. Regression testing is based on the significance level (Sig.) The Wald test shows that: X1, X3-X6, X8, and X10 have Sig. > 0.05. Consequently, the correlations are not significant for the Y4 variable, with a 95% confidence interval. X2 and X7 have Sig. = 0.086 and 0.030 < 0.1. Consequently, the correlation coefficients are significant for Y4, with a reliability of 90%; variable X9 has Sig = 0.002 < 0.01. The correlation coefficients are significant with Y4, and the reliability is 99%. Validation of the model: with 132 households involved in land contribution, the model correctly predicted 123 households; the accuracy rate is 93.2%. The remaining 306 households did not participate, but the model predicted 303 households; so the accuracy rate is 99.0%. Therefore, the predicted accuracy rate of the whole model is 96.1%. The Omnibus test shows that Sig. = 0.001 < 0.01 (99% confidence). Thus, independent variables have linear relationships with dependent variables in the aggregate. The model selection is appropriate.

The percentage of income from agriculture and household

with family members working as community leader impacts land contribution directly. The number of staff involved in land use and land contribution is better than that of other community members by 0.795m<sup>2</sup>. This is also explained by the “role model”. The percentage of income from agriculture also has an impact on the contribution of land, with an impact of 1.80% of the value of the contribution, which is interpreted to indicate that rural people have lower incomes than urban land prices. Therefore, the decision on land contribution does not depend much on income, but the land contribution is usually only related to households with land near the road to be expanded. Other households whether qualify to contribute or not, the contribution of land to rural transport infrastructure development, besides the dependence on the conditions of households near the road, are important to the community of people involved.

## 5. RESULTS AND DISCUSSION

Results indicate a few factors that have a medium to high impact on each category of community participation. A preliminary validation, obtained by common-sense arguments, is followed as:

### 5.1. Financial Contribution

*Ggender* (negatively medium), *education* (positively medium), and *household number of the workforce* (negatively medium). Because of the way *gender* was coded (0 is female and 1 is male), the result indicates that households that are represented by male citizens tend to participate more in financial contribution. The reason behind this interesting observation requires another socio-economic study, assuming that the more educated the citizens, the more aware they are of the benefits of local transport infrastructure for themselves; furthermore, they can afford to contribute financially. Hence, the effect of *education* is validated. The negative impact of *the household number of the workforce* can come from the famous negative correlation between the number of children to the financial well-being of families in Vietnam.

### 5.2. Labor Contribution

*Occupational training level* (negatively medium), *income class* (negatively high), *household member as a community leader* (positively high), and *the terrain of a living area* (positively high). If a person is highly trained occupationally, he/she is likely working full-time in that occupation, hence has less free time to contribute labor to the local projects. Similarly, a high-income household would instead contribute more financially than direct labor. The high effect of *a household member as a community leader* is interesting. This confirms the motivation of the good social model, as verified in the literature, as to why people volunteer. The positively high effect of *the terrain of the living area* was hard to reason, but one potential explanation could be the relationship between the types of jobs of the local people and the terrains that surround them.

### 5.3. Material Contribution

*Gender* (negatively medium), *occupational training level*

(positively high), *education* (negatively medium), and *the terrain of living area* (positively medium). Impacts of these characteristics are hard to reason since there should be further studies considering which types of materials contributed to the projects.

#### 5.4. Land Contribution

*Gender* (negatively medium), *household member as a community leader* (positively high), *the terrain of a living area* (positively medium). Land contribution is by far the most interesting observation in community participation, and this type of contribution is one of the most important factors that affect the schedule of all infrastructure projects in Vietnam. Again, *household member as community leader* plays an important role in determining whether a household will donate its land to the community. The medium impact of *the terrain of a living area* could have resulted from the land requirements from rural transport projects: projects located in flat surface areas are more common and require more land.

The findings of this study can benefit the government in the following areas:

##### 5.4.1. The Planning Process of the Development of Government's Rural Transport System

“Public [community] participation is a continuous effort of every transportation planning and project development process... transportation planners need to be aware of the expectations of an effective and successful program” [13]. Many variables must be considered in the process of planning transport systems. Since the governments are fully aware of the demographics of each area, they can predict the demands and resources of the area, which in turn provide benefit to the planning process.

##### 5.4.2. The Capability of the Government to Predict the Outcomes of Current Development Programs

Any model built by the government to predict the outcomes of a development program would use community participation as an input variable. In circumstances in which community participation has not been first-order determined (e.g., by surveys), an understanding of demographic characteristics can provide a shorthand for community participation.

##### 5.4.3. An Opportunity to Increase the Probability of Success of Considered Programs through Increasing Community Participants

Revisiting classification by Shye (2009) [18], wherein causes of community participation come from three major classes: demographic antecedents, motivations, and circumstances. Aside from demographic antecedents, which

were determined previously, the latter two notions can be facilitated as well to increase community participation.

##### 5.4.3.1. Increasing Motivations of Local Citizens

This is out of the scope of this study but it is no doubt an interesting route for future research.

##### 5.4.3.2. Facilitating Circumstances

This route can be started with the following two activities.

Activity 1. Develop flexible participation mechanisms with a well-coordinated process among stakeholders. The purpose of this activity is to organize the community, and the government together to create regulations that facilitate the participation of stakeholders. There are four factors involved in this activity:

(i) Government: The government works with community organization representatives to discuss mechanisms and policies for participatory planning. This is to implement community consultation.

(ii) Community organization representatives coordinate with mass organizations and/or self-media, and consult the community for issues that require broad consultation, such as participation mechanisms, participation levels, *etc.* Individuals of the community coordinate with specialized units, consultants, with professional content related to ICT infrastructure development to improve the knowledge and communication of the community, and ensure maximum transparency.

(iii) Community participation: The participation mechanism is to collaborate with community organizations to engage in discussion, feedback, information provision, *etc.*, on issues related to participation and information. Related news: associate with mass organizations and professional advisory units to capture relevant information in support of participation decisions.

(iv) Mass organizations: The mechanism of action is to coordinate with the authorities to propagate mechanisms and policies for the participation and information provision of community organizations (coordination in propaganda) and community (extended communication), volunteering to contribute as a pioneer of the community organization to involve the community, *etc.*

(v) Specialized units: The operational mechanism is to coordinate with the authorities in consultation and discussion related to the profession, collaborate with community organizations to explain and provide relevant information, and support communication.

Activity 2. Develop a transparent participation procedure. A transparent procedure will facilitate and initiate the willingness of local citizens to volunteer. The procedure is depicted in Fig. (6).

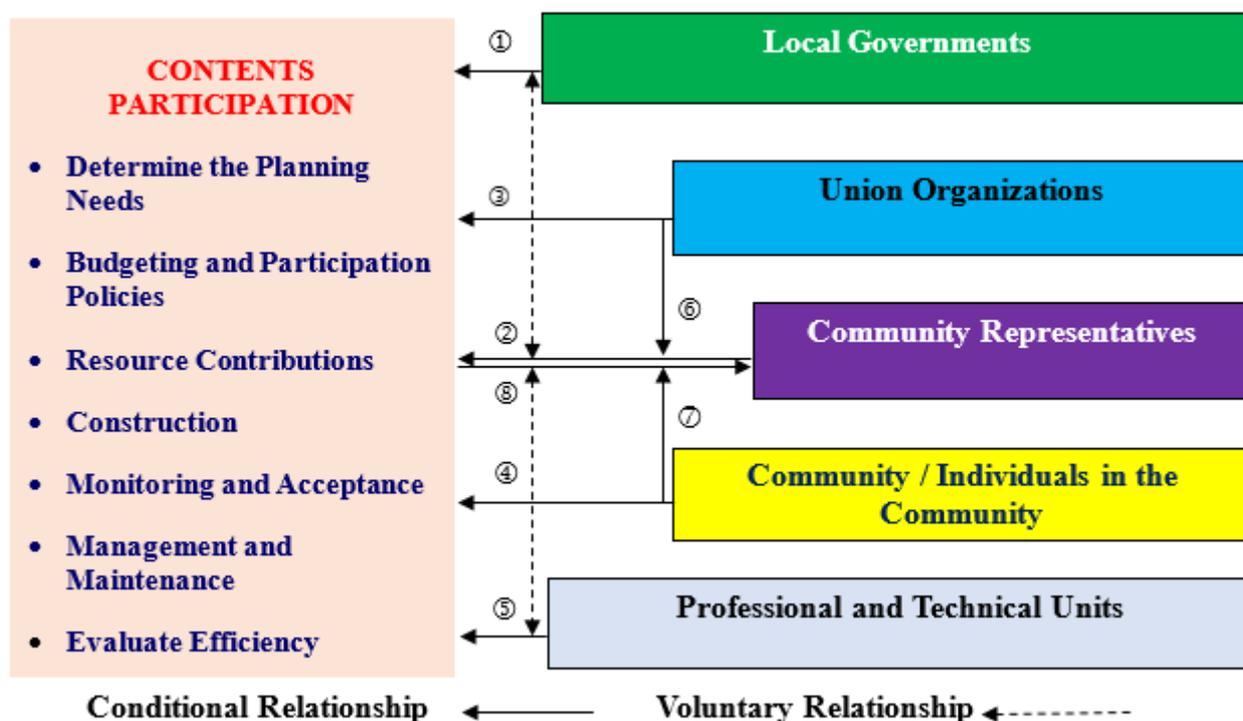


Fig. (6). Proposed participation procedure that prioritizes transparency.

- Step 1: The government and community representatives initiate the need for rural infrastructure development and propose community participation and public consultation.

- Step 2: The government and community representatives consult with specialized agencies on issues, content, and participation for rural people.

- Step 3: The government and community representatives consult with mass organizations on propaganda and mobilization of the community to participate in enhancing the transportation infrastructure of rural areas and the contents and forms of community participation.

- Step 4: The government and community representatives agree on issues related to rural infrastructure development and participation.

- Step 5: Mass organizes organizations and professional and technical units to train the community through its representatives.

- Step 6: Community representatives consult, discuss and agree with the local people on contents related to rural transportation infrastructure development and contents, forms, and activities on community participation.

- Step 7: Community entities decide to contribute directly to the process.

- Step 8: Tasks are conducted to summarize, evaluate and draw experience and lessons learned from community participation and the participation of stakeholders.

**CONCLUSION AND RECOMMENDATIONS**

In developing countries, such as Vietnam in general and South-eastern provinces in particular, community participation benefits the development of rural transport infrastructure in many ways by providing alternatives of financial resources and enhancing public support. This study examined the current status of community participation through a case study and explored the relationship between demographic characteristics and community participation. Results show that community participation in rural transport programs in Vietnam has four types, including financial contribution, labor contribution, material contribution, and land contribution. Household composition, education, income, and the member in a household as a community leader impact community participation more than other factors.

Governments and policymakers can be benefited from this study in terms of the planning process, predicting success outcomes, and increasing the effectiveness of rural transport development. Moreover, policies should make rural transport programs clearer to local citizens and should facilitate contribution in various forms. Flexible participation mechanisms and transparent participation procedures are also strongly advised to boost community participation. Future studies might expand to other areas in Vietnam, as well as other developing countries, to validate the influence of demographic characteristics.

**CONSENT FOR PUBLICATION**

Not applicable.

## AVAILABILITY OF DATA AND MATERIALS

The data and materials used to support the findings of this study are available from the corresponding author (D.T.H) upon reasonable request.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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