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RESEARCH PAPER

Sustainability consciousness in higher education: Construction of three-dimensional sustainability and role of locus of control

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Abstract. This study aims to analyze the level of sustainability awareness among university students, especially focusing on their knowledge, attitudes, and behavior related to sustainability across three main dimensions: environmental, social, and economic. Additionally, the study explores whether these behaviors are influenced by individuals' beliefs about their ability to effect change. This study employed a quantitative approach involving all active students enrolled in the Faculty of Economics and Business, Universitas Negeri Semarang. A samples of 233 respondents was selected using a non-probability sampling method. Data was collected through a questionnaire and analyzed using the Structural Equation Modeling Partial Least Square method. The study findings reveal that attitude towards sustainability have stronger influence on behavior than knowledge. Respondents' demonstrated a higher level of understanding of sustainability compared to their attitudes and behaviors towards it. Furthermore, concerns to economic aspects were found to impact sustainability behaviors. Most respondents expressed a belief that events around them are beyond their control. This article is expected to significantly contribute to aligning policies and practices, particularly in fostering sustainability awareness, and serve as a basis for achieving sustainable development initiatives.

Keywords: Sustainability consciousness; Locus of control; Sustainability behavior; Sustainability knowledge; Sustainability attitude; Higher education.

1. Introduction

Sustainable development for the entire world's entire population is the greatest challenge of the 21st century (Ranjbari et al., 2021; Sachs et al., 2022). Unfortunately, research indicates that progress toward this goal has been much slower than anticipated, and in some aspects, conditions have even worsened over the past decade (Baumgartner & Rauter, 2017). Knowledge about sustainability can influence people's attitudes and behaviors and enhance their capacity to address with environmental issues (Agbedahin, 2019). However, merely understanding sustainability is insufficient, this understanding must be reflected in attitudes and behaviors (Mihelcic et al., 2003). Sustainability awareness refers to knowledge, attitudes, and behavior

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related to sustainability (Olsson et al., 2019). The first step in fostering sustainability is to examine these three dimensions of sustainability awareness.

The intended behavior is not always displayed, even the right environment and knowledge are provided. Human belief systems, often referred to as locus of control, including internal and external locus of control, may be contributing factor. The theory of planned behavior (TPB) (Fishbein & Ajzen, 1977) posits that human behavior is the outcome of rational judgments rather than deliberate actions (Gibbons et al., 2018), and is influenced by attitudes, subjective norms, and perceived behavioral control (Ajzen & Fishbein, 1980; Gibbons et al., 2018; Kroshus et al., 2014; Montano & Kasprzyk, 2015).

According to TPB, sustainability behavior is a cognitive process shaped by knowledge and attitudes. Additionally, individual behavior is influenced by their belief system, which is explored as a locus of control in this study. Previous research has demonstrated that expanding knowledge about sustainability can alter a person's attitudes, values, goals (Ajzen & Fishbein, 1980; Perloff, 2016), and behavior (Schultz, 2002). Many worldwide educational programs and activities related to sustainability are built upon this premise (Sharma et al., 2014). Based on these findings, the following hypothesis is proposed.

H1: Sustainability knowledge affects sustainability behavior

According to TPB, human behavior is guided by behavioral intentions, which are influenced by attitudes and affect sustainability behavior (Cheung & To, 2019; Han et al., 2019; Karpudewan, 2019; Kim et al., 2020). However, a change in attitude does not necessarily translate into a change in behavior because learned attitudes can fade over time (Karavasilis et al., 2015). Therefore, it is essential to understand how sustainability attitudes influence sustainability behavior. The following hypothesis was developed to further explain this.

H2: Sustainability attitude influences sustainability behavior

Pro-environmental initiatives are complex subjects involving various external and internal factors (Heimlich et al., 2013). However, research has shown that despite possessing the necessary knowledge, individuals often do not engage in environmental protection behaviors. This tendency is influenced by their beliefs about whether events are controlled by external forces or within their own control, known as locus of control. Based on these principles, we assume that locus of control influences sustainability knowledge, attitudes, and behavior, as follows.

H3: Locus of control affects awareness of sustainability
H3a: Locus of control affects knowledge of sustainability
H3b: Locus of control affects sustainability attitudes
H3c: Locus of control affects sustainability behavior
H4: Locus of control moderates the relationship between sustainability knowledge and behavior
H5: locus of control moderates the relationship between attitudes and behavior towards sustainability

There remains a notable gap in research concerning students' knowledge, attitudes, and behavior in higher education with regard to addressing sustainability issues (Borges, 2019; Cotton et al., 2007; Singer-Brodowski, 2017). Despite the acknowledged influence of education on student behavior (Brody & Ryu, 2006), students have received relatively limited attention in sustainability studies (Murray, 2018). Furthermore, much of the existing sustainability research tends to be descriptive in nature (Barth & Rieckmann, 2012), with few studies focusing specifically on the Asian continent (Kalsoom et al., 2017; Olsson et al., 2019; Zhao et al., 2020). This study aims to analyze the current level of sustainability awareness among university students, particularly examining the development of sustainability knowledge, attitudes, and behaviors, and exploring whether these behaviors are influenced by individuals' beliefs in their capacity to effect change.

Sustainability awareness involve evaluating our current position and determining our desired future trajectory. Furthermore, comprehending and addressing the complexities of our environment requires a deep understanding of sustainability (Wals & Jickling, 2002). To assess sustainability awareness, this study examine three key constructs - sustainability knowledge, attitudes, and behaviors - across three dimensions: environment, society and economy (Gericke et al., 2019). The scale developed by Gericke et al. (2019) is employed in this research due to the creation and validation of a questionnaire covering 15 UNESCO sub-themes related to sustainability knowledge, attitudes, and behaviors (Aleixo et al., 2018). These three constructs are then subsequently linked to three dimensions - environmental, social, and economic.

The current state of research in this field is reflected in the ongoing development of awareness through knowledge, attitudes, and behavior. These three constructs are then associated with environmental, social and economic dimensions. Sustainability behavior may not always manifest, even when environmental knowledge has been provided, due to human beliefs, a concept known as locus of control. This model is constructed based on the theory of planned behavior (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1977). The novelty of this research lies in its incorporation of the three dimensions of sustainable development, environmental, social and economic, to examine the formation of sustainability awareness.

2. Material and method

This research aims to develop a conceptual model of sustainability awareness encompassing the constructs of knowledge, attitudes, and behavior related sustainability, with moderated by locus of control. The construction of sustainability awareness is considered across three dimensions: environmental, social and economic. This study adopts a quantitative approach, with a clausal associative research design to analyze the relationships and the impact of variables on one another. The research was conducted at the Faculty of Economics and Business, Universitas Negeri Semarang (FEB UNNES), with a target population of all active students at the FEB UNNES. The sample selection employed nonprobability sampling, resulting in a total sample of 223 respondents, determined based on the data on structural analysis (Ferdinand, 2014).

The data utilized in this research consists of primary data collected through the distribution of research questionnaires to the respondents. Data collection employed the questionnaire method utilizing a seven-point Likert scale ranging from “agree” (scale 7) to “disagree” (scale 1). Questionnaires were distributed to respondents online using the Google form. Data analysis technique was based on Structural Equation Modeling Partial Least Square (SEM PLS) using the WarpPLS 8.0 program. The data analysis in this study included validity and reliability analysis, as well as inferential statistical analysis.

3. Result and discussion

3.1. Descriptive statistical analysis

This research model incorporates sustainability behavior (SB) as the dependent variable, with sustainability knowledge (SK) and sustainability attitude (SA) serving as independent variable, and locus of control (LOC) as the moderating variable. Descriptive statistical analysis results for each variable are presented in Table 1.

Based on descriptive statistical analysis results (Table 1), the study's unit of analysis comprises 223 respondents. For the sustainability behavior variables, all three dimensions exhibit consistent minimum and maximum values of 3 and 12, respectively. However, the average for each dimension varies. The social dimension shows the highest average value of 18.42 with a standard deviation value of 5.46. The environmental dimension has an average value of 15.82 and a standard deviation of 3.303, while the economic dimension’s average value is 24 with standard deviation of 3.51. These values indicate that the data for the social dimension of SB variable display the highest standard deviation, suggesting greater variability and is less homogeneity compared to the other two dimensions of SB.

Table 1. Results of variable descriptive statistical analysis

Variable	Dimensions	N	Min	Max	Means	std. Deviation
Sustainability Behavior (SB)	Environment	223	3	21	15,82	3,303
	Social	223	3	21	18,42	5,46
	Economy	223	3	21	14	3.51
Sustainability Knowledge (SK)	Environment	223	6	21	15,9	2,989
	Social	223	3	21	18.35	2,915
	Economy	223	6	21	17.79	2,839
Sustainability Attitude (SA)	Environment	223	3	21	18.34	2,776
	Social	223	3	21	18,3	2,807
	Economy	223	3	21	17.99	2.73
Locus of Control (LOC)		223	5	35	4,967	23,475

In this study, sustainability knowledge exhibits a maximum value of 21 across all dimensions. However, the social dimension has a lower minimum value of 3 compared to the environmental and economic dimensions, which have a minimum value of 6. the average value for the social dimension is 18.35 with a standard deviation of 2.915. The economic dimension shows an average value of 17.79 with a standard deviation value of 2.839, while the environmental dimension has an average value of 15.9 with a standard deviation of 2.989. These results indicate that the environmental dimension of the variable SK variable demonstrates greater data variability compared to the economic and social dimensions of the same variable

Each dimension on the sustainability attitude variable exhibits uniform minimum and maximum values of 3 and 21. The average values for the environmental, social and economic dimensions are 18.34, 18.3, 17.99 respectively, with corresponding standard deviations of 2.776, 2.807, and 2.73. These results indicate that the social dimension displays greater variability in data compared to environmental and the economic dimensions. Conversely, the economic dimension shows the lowest data variability and is considered more homogeneous when compared to the other dimensions within the SA variable.

Locus of control in this study is not operationalized using three dimensions like the variables SB, SK and SA. Locus of control is represented by five question identifiers, resulting in a data distribution ranging from a minimum value of 5 to a maximum of 35, with an average value of 4.967. These results suggest that students' locus of control tends to be high, as indicated by the average value approaching the maximum value. Furthermore, the data distribution for the locus of control variable exhibits significant variability, as evidenced by the large standard deviation of 23.476.

3.2. Evaluation of the measurement model (Outer model)

The evaluation of convergent validity involves ensuring that the loading value in the combined loading cross-loading output is a greater than 0.7. Construct with loading values below 0.7 cannot be included in the analysis model. Additionally, meeting requirements for convergent validity involves ensuring that the *p*-value for each construct is greater than 0.5. The analysis of convergent validity identified indicators that did not meet these requirements, namely SK1 and SK3 indicators for sustainability knowledge, SA1 and SA2 indicators for sustainability attitude, SB5 and SB7 indicators for sustainability behavior, and LC5 indicators for locus of control. These indicators had loading value below 0.7 and were therefore removed from the analysis model. The output of the combined loading cross-loading after removing these indicators can be seen in Table 2.

The combined loading cross-loading output results presented in Table 2 demonstrate that all indicators for each variable have met the criteria for convergent validity based on the loading value. Convergent validity is not solely determined by loading values but also required that the

Average Variance Extract (AVE) value greater than 0.05. The AVE values for this research model can be found in the output of the latent variable coefficients presented in Table 3. The latent variable coefficients indicates that all variables have achieved convergent validity, as evidenced by the AVE values exceeding 0.5 for each variable. Specifically, the AVE values are 0.644, 0.618, 0.581, 0.590, 1.000, and 1.000 for the respective variables.

Table 2. Loading value after elimination

Variable	Indicator	Loading value	*p*-value	Information
Sustainability Behavior (SB)	SB1	(0.801)	<0.001	Meets convergent validity
	SB2	(0.863)	<0.001	Meets convergent validity
	SB3	(0.719)	<0.001	Meets convergent validity
	SB4	(0.861)	<0.001	Meets convergent validity
	SB6	(0.817)	<0.001	Meets convergent validity
	SB8	(0.793)	<0.001	Meets convergent validity
	SB9	(0.751)	<0.001	Meets convergent validity
Sustainability Knowledge (SK)	SK2	(0.736)	<0.001	Meets convergent validity
	SK4	(0.766)	<0.001	Meets convergent validity
	SK5	(0.850)	<0.001	Meets convergent validity
	SK6	(0.845)	<0.001	Meets convergent validity
	SK7	(0.821)	<0.001	Meets convergent validity
	SK8	(0.726)	<0.001	Meets convergent validity
	SK9	(0.747)	<0.001	Meets convergent validity
Sustainability Attitude (SA)	SA3	(0.754)	<0.001	Meets convergent validity
	SA4	(0.814)	<0.001	Meets convergent validity
	SA5	(0.756)	<0.001	Meets convergent validity
	SA6	(0.780)	<0.001	Meets convergent validity
	SA7	(0.750)	<0.001	Meets convergent validity
	SA8	(0.727)	<0.001	Meets convergent validity
	SA9	(0.752)	<0.001	Meets convergent validity
Locus of Control (LOC)	LC1	(0.749)	<0.001	Meets convergent validity
	LC2	(0.775)	<0.001	Meets convergent validity
	LC3	(0.798)	<0.001	Meets convergent validity
	LC4	(0.750)	<0.001	Meets convergent validity
LC*SK		(1,000)	<0.001	Meets convergent validity
LC*SA		(1,000)	<0.001	Meets convergent validity

Table 3. Output latent variable coefficients

	SB	SK	SA	LC	LC*SK	LS*SA
Avg. Var. Extract	0.644	0.618	0.581	0.590	1,000	1,000

Based on Table 4, it is observed that the square root of the AVE values for the variables of sustainability behavior, sustainability knowledge, sustainability attitude, locus of control, the interaction variable of locus of control with sustainability knowledge (LC*SK), and the interaction variable of locus of control with sustainability attitude (LC*SA) are 0.802, 0.786, 0.762, 0.768, 1.000, and 1.000, respectively. These values are higher than the correlation values between constructs within each variable column, indicating that the model meets the criteria for discriminant validity.

Composite reliability testing is conducted by examining the coefficient of the output latent variable. A model is deemed to meet the composite reliability requirements if it achieves a value of > 0.70. The output of the latent variable coefficients for this research model is presented in Table 5. Based on Table 5, it is evident that all variables have met the composite reliability requirements, as each has achieved a value greater than 0.7.

Table 4. Correlations among latent variables

	SB	SK	SA	LC	LC*SK	LS*SA
SB	(0.802)	0.784	0.686	0.358	-0.543	-0.479
SK	0.784	(0.786)	0.616	0.391	-0.509	-0.389
SA	0.686	0.616	(0.762)	0.343	-0.426	-0.379
LC	0.358	0.391	0.343	(0.768)	-0.199	-0.134
LC*SK	-0.543	-0.509	-0.426	-0.199	(1,000)	0.832
LC*SA	-0.479	-0.389	-0.379	-0.134	0.832	(1,000)

Table 5. Output latent variable coefficients

	SB	SK	SA	LC	LC*SK	LS*SA
Composite Reliability	0.926	0.918	0.907	0.852	1,000	1,000

3.3. Evaluation of the inner structural model

Based on the fit and quality indices of the model, the values obtained from the ten criteria have been met, indicating that the model satisfies the fit requirements (see Table 6). The estimation results of the indirect effect model are illustrated in Figure 1.

Table 6. Model fit and quality indices

Model fit & quality indices	Index	*p*-values	Criteria	Information
Average path coefficient APC	0.292	$p = 0.001$	$p < 0.05$	Acceptable
Average Rsquared ARS	0.355	$p = 0.001$	$p < 0.05$	Acceptable
Average adjusted Rsquared AARS	0.350	$p = 0.001$	$p < 0.05$	Acceptable
Average block VIF AVIF	4.158	acceptable if ≤ 5, ideally ≤ 3.3		Acceptable
Average full collinearity VIF AFVIF	2.762	acceptable if ≤ 5, ideally ≤ 3.3		Ideally
Tenenhaus GoF GoF	0.512	small ≥ 0.1, medium ≥ 0.25, large ≥ 0.36		Large
Sympson's paradox ratio SPR	0.857	acceptable if ≥ 0.7, ideally = 1		Acceptable
R-squared contribution ratio RSCR	0.936	acceptable if ≥ 0.9, ideally = 1		Acceptable
SSR statistical suppression ratio	1.000	acceptable if ≥ 0.7		Acceptable
Nonlinear bivariate causality direction ratio NLBCDR	1.000	acceptable if ≥ 0.7		Acceptable

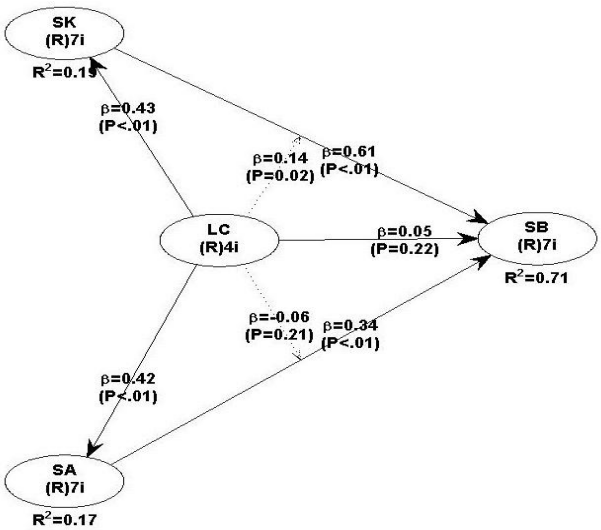

Figure 1. Indirect effect model test results

Testing of the structural model was conducted by examining the R^2 which is a goodness-of-fit model test. The results indicate that the R^2 value on the variables sustainability behavior,

sustainability knowledge, sustainability attitude, and locus of control as a moderating variable is 0.71, indicating that the exogenous latent variables in this study can explain 71% of the variance in sustainability behavior. Additionally, Q-squared is utilized to evaluate the predictive validity or relevance of a set of latent predictor variables on the criterion variable. Models demonstrating predictive validity should have a Q-squared value > 0. Table 7 presents latent variable coefficients illustrating the Q-squared values of the latent predictor variables on the criterion variable.

Table 7. Output latent variable coefficient that describes Q-squared

	SB	SK	SA	LC	LC*SK	LS*SA
Q-Squared	0.703	0.191	0.180	-	-	-

Table 8. Research hypothesis test results

Hypothesis	Hypothesis Test Results		
	Coefficient	Sig.	Information
Sustainability knowledge influences sustainability behavior	0.609	<0.001	Accepted
Sustainability attitude influences sustainability behavior	0.337	<0.001	Accepted
Locus of control affects knowledge of sustainability.	0.432	<0.001	Accepted
Locus of control influences the attitude of sustainability.	0.416	<0.001	Accepted
Locus of control influences sustainability behavior.	0.054	0.219	Rejected
Locus of control moderates the relationship between knowledge and sustainability behavior.	0.140	0.021	Accepted
Locus of control moderates the relationship between attitudes and behavior towards sustainability.	-0.056	0.211	Rejected

The results of the output of the latent variable coefficients show that the Q-squared value for the sustainability behavior variable is 0.703. This indicate that the research model has predictive relevance as it has a Q-squared value greater than zero. The hypothesis testing in Table 8 reveals that out of the 7 proposed hypotheses, 5 were accepted, while 2 were rejected. The rejected hypothesis concerns the direct effect of locus of control on sustainable behavior, as well as the moderating influence of locus of control between attitudes and sustainable behavior. The accepted hypothesis (H1, H2, H3, H4, and H6) demonstrate significant effects according to the analysis.

3.4. Discussion

Sustainability has emerged as a significant global concern, particularly in countries like Indonesia with sizable youth population. Among these young individuals, those in higher education play a pivotal role in driving awareness about sustainability. However, initial findings suggest that while tertiary education students possess some knowledge of sustainability, this awareness does not consistently translate into their chosen approaches and attitudes toward sustainability, nor does it manifest in their actions (refer to Table 1).

These findings confirm previous research, indicating a wider gap between knowledge, attitudes, and behavior regarding sustainability compared to the gap between attitudes and behavior alone. Therefore, it is crucial to recognize that increasing sustainability knowledge represents an initial step in sustainable development. However, if this knowledge does not influence attitudes and behavior, effort toward sustainable development may not succeed. Ultimately, sustainable levels are determined by actual behavior, despite individuals possessing sustainability knowledge. Research by Heeren et al. (2016) suggests a prevalent misconception that unsustainable behavior primarily stems from a lack of knowledge. Thus, we believe that individuals are more likely to adopt sustainability behaviors when they are aware of them.

At the level of attitudes, knowledge gaps become more apparent among respondents. They expressed the belief that equitable access to education and employment opportunities is essential for sustainable development. However, they are not yet fully aware that the overuse of natural

resources can have long-term detrimental effects on human health and well-being. Furthermore, they do not fully grasp how inappropriate use of natural resources will impact the health and well-being of future generations. Studies also demonstrate that a person's attitude can influence their behavior (Cheung & To, 2019).

According to research by Cooper and Gutowski (2017), although reuse has a significant impact on the environment, it has not received much attention. The findings from this study indicate that sustainability behavior is influenced by sustainability knowledge and attitudes, with attitudes having a greater impact on sustainability behavior than knowledge. This finding aligns with a study conducted by Vicente-Molina et al. (2013). To achieve sustainable development goals, it is crucial to focus on influencing significant attitudes towards sustainability.

The main findings of this study focus on observations related to the external locus of control among respondents. The average value of all locus of control items is 4.967, indicating that the average respondent tends towards an external locus of control, believing that events occurring to them or around them are largely influenced by factors beyond their control. Individuals with an external locus of control perceive their behavior as being shaped by external forces such as chance or fate, rather than internal cognitive processes. These findings suggest that locus of control significantly and positively influences respondents' sustainability knowledge and attitudes. However, the research results also reveal that overall, locus of control does not have a significant effect on sustainability behavior (refer to Table 8). This strengthens the theoretical basis of planned behavior, suggesting that individual behavior is influenced by complex cognitive processes and decision making.

Regarding sustainability attitudes, this study found that the environment has the most significant influence on locus of control, whereas society has a lesser impact on locus of control. Both dimensions (environment and society) positively and significantly influence on locus of control, consistent with the findings of previous research by Chiang et al. (2019). The main findings of this study also highlight differences in respondents' perceptions of internal and external locus of control. The results demonstrate variations between the two groups in terms of sustainability knowledge, attitudes, and behavior (see Table 8).

Locus of control significantly influences the sustainability awareness of respondents with an internal locus of control. Conversely, respondents with an external locus of control show differences in this regard, consistent with previous studies (e.g. Derdowski et al., 2020; Di Fabio & Saklofske, 2019). This difference may stem the fact that individuals who feel accountable for their actions and perceive the ability to effect changes are more inclined to engage in environmentally beneficial behaviors.

The managerial implication of this research is that it identifies a gap between sustainability knowledge and behavior, particularly in countries like Indonesia and India, which have significant potential to contribute to global sustainable development goals. Sustainability awareness encompasses various aspects, this, it is crucial to determine the strongest and the weakest dimensions among the three aspects. Understanding the perspective of Indonesian youth is very important for developing educational and communication methods that can enhance their knowledge, influence their attitudes, and ultimately change their behavior in the future. The findings from this research offer insights into how institutions and governments can take actionable steps and formulate relevant policies to ensure sustainable development.

Despite efforts to increase sustainability awareness, knowledge about sustainability will not translate into behavioral change until individuals believe in their capacity to effect environmental change (possessing an internal locus of control). This important insight can underpin future government activities and campaigns. Therefore, it is recommended that future research expand the sample size and research scope, explore novel research methodologies, and identify additional factors influencing sustainability knowledge. Furthermore, future research can qualitatively

analyze methods for cultivating sustainability attitudes and comprehending sustainability behavior.

4. Conclusion

The conclusion drawn from this research is that sustainability awareness mapping reveals respondents possess a higher understanding of sustainability knowledge, but this understanding is not always reflected in their attitudes and behavior. Even though sustainability knowledge and attitudes impact on sustainability behavior, analysis of three dimensions indicates that the respondents with a greater understanding of economic issues exhibit higher sustainability awareness. Furthermore, respondents who understand the social impact of sustainability tend to recognize the importance of sustainable development more profoundly. This study also identifies that sustainability attitudes are influenced by social and economic concerns, which can in turn influence sustainability behavior. For example, the economic dimension is observed to contributes to changes in attitudes towards sustainability.

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