Making Sense of Mediating Analysis: A Marketing Perspective

Review of Integrative Business & Economics Research

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ABSTRACT

In the structural model, it is a necessary but not sufficient condition to compare the beta of direct path with the product term of indirect path to interpret the results of mediation analysis. This study applies a step-by-step process on illustrative data by means of PLS-SEM with the application of SmartPLS3. It evaluates four variables (perceived value, service quality, customer satisfaction and customer loyalty) from the literature on marketing. Survey results confirm the validity of measurement models, and predictive relevancy of the structural model. These four variables explain a large amount of variance. The study also found that the effect of mediator on the R^2 (endogenous latent variable) value is large. Furthermore, the study found the significance of indirect effect with a t value above 1.96. On magnitude of mediation, the survey confirmed customer satisfaction as a mediator, fully mediating the relationship between perceived value and customer loyalty; while customer satisfaction as a mediator partially mediates the relationship between service quality and customer loyalty. In conclusion, the paper offers a comprehensive understanding of mediation analysis.

Keywords: Mediating analysis; customer satisfaction; customer loyalty; perceived value; service quality; PLS-SEM.

1 INTODUCCTION AND BACKGROUND

In the growing trend of 2nd-generation structural equation modeling (PLS-SEM), the analysis, and reporting of complex models (particularly the mediation model) is a challenge. Studies, therefore, often draw conclusions concerning mediation analysis based on step rather than process. In their book "*A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM)*", Hair et al. (2014: 224) discuss the importance of mediation analysis, mentioning that mediation analysis in PLS-SEM is a step-by-step activity (a process) rather than a step. They further clarify that comparing the beta of direct path with the product term of indirect path (compound path) is a necessary but not sufficient condition for mediation analysis. This present study seeks to go beyond, to assist researchers, students, and academicians in comprehending the nature of mediation analysis using PLS-SEM through

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illustrative data obtained from Irfan (2016)[1]. The model will be designed, analysed, and reported in SmartPLS3.

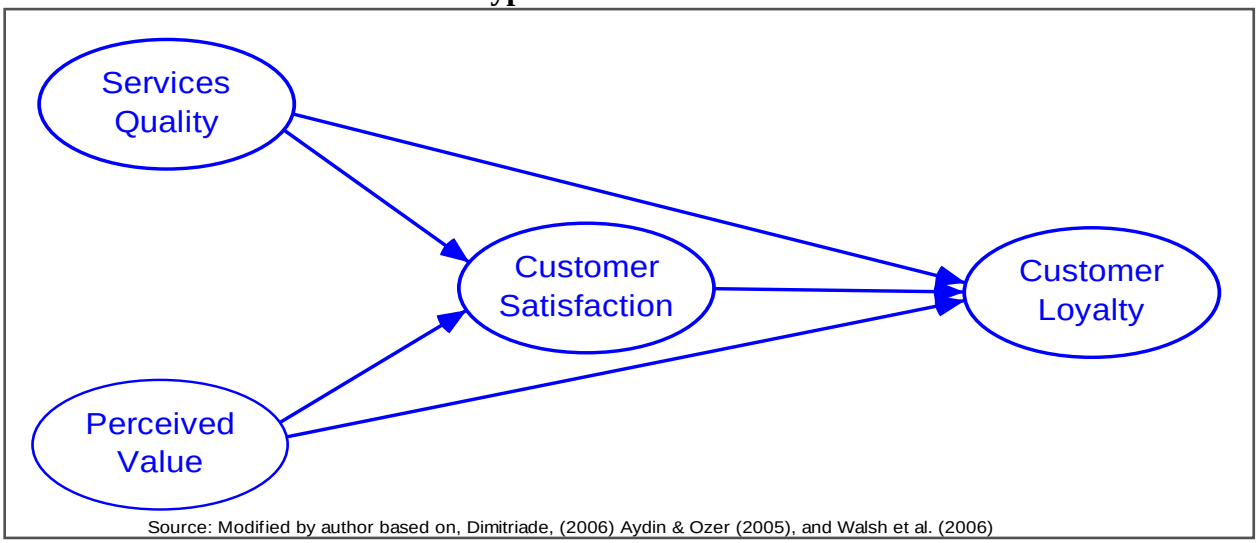
2 THEORETICAL FRAMEWORK FOR CUSTOMER LOYALTY

The dependent variable in this study is customer loyalty, which is the variable of primary interest. We attempt to explain the variance in customer loyalty by means of two independent variables and one mediator variable of:

- Service quality
- Perceived value
- Customer satisfaction (mediator)

Service quality is the attitude of service providers concerning a particular service (Fogli, 2006). A high level of services is a key factor of success for competitive advantage in businesses (Bharati & Berg, 2005; Yoo & Park, 2007; Kemp, 2005). Perceived value refers to the value consumers received from the value they paid (Park et al., 2006).
The higher the quality of service[2] as perceived by the customer, the higher the customer loyalty towards the service provider. Similarly, the higher the value as perceived by the customer, the higher the level of customer loyalty towards the service provider. We may say that providing a high level of services satisfies customers, and this satisfaction in turn positively affects customer loyalty. Likewise, greater value received by customers positively affects their level of satisfaction, which in turn affects customer loyalty.

Hypothesized model



Source: develop for this research, Figure, 1

2.1 Development of Hypotheses

When we acknowledge the importance of variables in a setting, and establish the relationships among them through logical reasoning in a theoretical framework, we are in a

[1] We thank Mr. Muhammad Irfan (master's student at the Unikl Business School) for permission to use illustrative data.
[2] Considering cultural differences and different research settings, the EFA establishes that service quality has two sub-constructs (responsiveness and reliability) (Hadi et al., 2016).

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position to test whether the relationships that have been theorised do, in fact, hold true. Such a testable statement is called a hypothesis.

$H1_a$: Service quality is statistically significant in influencing customer loyalty.
$H1_b$: Service quality is statistically significant in influencing customer satisfaction.
$H2_a$: Perceived value is statistically significant in influencing customer loyalty.
$H2_b$: Perceived value is statistically significant in influencing customer satisfaction.
H3: Customer satisfaction is statistically significant in influencing customer loyalty.

2.1.1 Customer Satisfaction as a Mediator

A positive relationship between service quality, customer satisfaction, and customer loyalty has been demonstrated by several studies. For example, Santouridis and Trivellas (2010) found that there is a positive correlation between service quality and customer satisfaction, which positively influences customer loyalty. Similarly, Deng et al. (2009), Anderson & Srinivasan (2003), Parasuraman & Grewal (2000), and Lim et al. (2006) found that service quality and perceived value contributed to customer satisfaction, and that customer satisfaction increased customer loyalty. Similarly, Turel and Serenko (2006) perceived service quality was a determinant of customer satisfaction, and ultimately, customer satisfaction lead to customer loyalty[3].Thus, we can hypothesise that:

$H4_a$: Customer satisfaction mediates the relationship between service quality and customer loyalty.
$H4_b$: Customer satisfaction mediates the relationship between perceived value and customer loyalty.

3 APPROACHES TOWARDS MEDIATION ANALYSIS

Mediation analysis uses one of three approaches:

- Baron and Kenny's (1986) mediation analysis
- The Sobel test (1982)
- The bootstrap method (Preacher and Hayes, 2004; 2008)

3.1 Baron and Kenny's Mediation Analysis

In Baron and Kenny's mediation analysis, the researcher must first establish that there is statistical significance between the dependent and independent variables. For example, there must be a positive and significant relationship between service quality and customer loyalty. Secondly, the researcher must show that there is a statistical significance between the independent variable and the mediating variable. For example, there must be a positive and significant correlation between service quality and customer satisfaction. Then, the researcher must illustrate a statistical significance between the mediating variable and the dependent variable. For example, there must be a positive and significant correlation between customer satisfaction and customer loyalty. Finally, the researcher must look at the direct effect after controlling for the mediating variable. If the inclusion of the mediator nullifies the direct relationship, there is full mediation; otherwise, mediation is partial or absent.

3.1.1 Criticism of Baron and Kenny's Approach

[3](See also: Kim et al., 2004; Turel & Serenko, 2006; Roig et al., 2006; Chen & Dubinsky, 2003; and Shams, 2010).

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This approach has been criticised for the following:
Pardo and Roman (2013) state that mediation may work out even when there is no statistical significance within the direct path (X → Y). This non-appearance of a relationship between X and Y in mediation analysis can happen for various reasons (For detail, see Pardo and Roman, 2013). Other researchers such as James et al. (2006), Collins et al. (1998), Shrout & Bolger (2002), MacKinnon et al. (2002), MacKinnon et al. (2002), Zhao et al. (2010), and even Judd & Kenny (2010) have also discussed that the initially significant path from X → Y can be overlooked. Secondly, in Baron and Kenny's analysis, there is a lack of potency while measuring the strength of mediation, since mediation analysis requires proper specification of hypothesis. As pointed out by James, et al. (2006), the mediational relationship (partial or complete) must be specified beforehand.

To identify the statistical significance of the mediator, Baron and Kenny (1986) and Kenny et al. (1998) popularised the Sobel test (Pardo & Roman, 2013).This test measures whether an intermediation effect is significant.

3.2 The Sobel Test

The Sobel (1982) test evaluates the significance of the mediator by finding the product of coefficients (service quality → customer satisfaction * customer satisfaction → customer loyalty). For example, c + d in Figure 2 (Venn diagram approach) represent the effect of service quality on customer loyalty. The area where the circle overlaps represents the correlation between service quality and customer loyalty, or the effect of service quality on customer loyalty.

This correlation can be broken down into the areas of c and d, c now representing the variance that service quality and customer loyalty have in common with customer satisfaction. This area also represents the product of coefficients (service quality → customer satisfaction * customer satisfaction → customer loyalty). Sobel's test examines the area of c. If the area of c is larger than the area of d, it represents the significance of Sobel's test, which is a sign of mediation:
$t = {}^{(\tau - \tau')}/_{SE}$ OR $t = {}^{(\alpha\beta)}/_{SE}$

If the test is significant, then we compare the product coefficients with the direct path:

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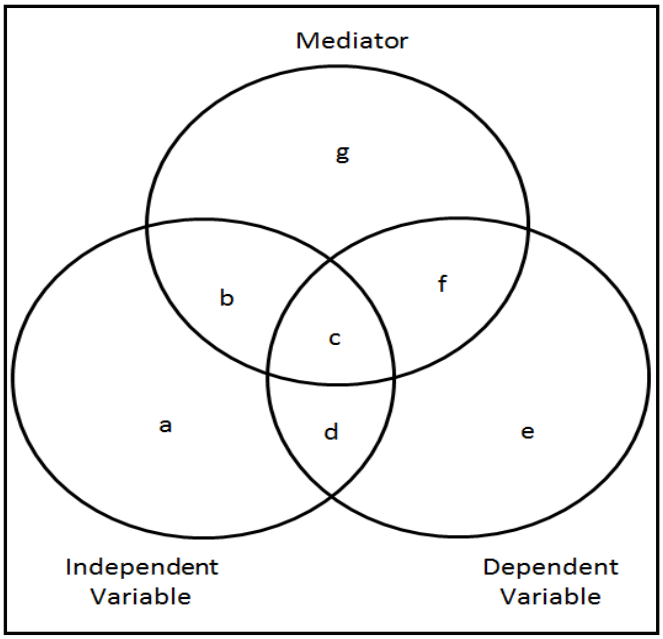
Sobel's approach of mediation



Source: https://en.wikipedia.org/wiki/Sobel_test Figure, 2

3.2.1 Criticism of the Sobel Test

Sobel's test depends on distributional assumptions, and according to Hair et al. (2014) and Bollen & Stine (1990), the distribution of indirect effect (service quality → customer satisfaction * customer satisfaction → customer loyalty) tends to be asymmetric (skewed, unless the means are much larger than the standard deviations) (Stone & Sobel, 1990; MacKinnon, Lockwood & Williams, 2004; MacKinnon et al., 2002).This asymmetry affects the applicability of Sobel's test when working with small sample sizes, since the distribution of the indirect effect is normal only at large sample sizes. The p value resulting from the formula is not a correct estimate of the true p value at smaller sample sizes. In order to address this, researchers (such as Shrout & Bolger, 2002; Bollen & Stine, 1990; Preacher & Hayes (2004, 2008) have suggested using the bootstrapping approach.

3.3 The Bootstrap Method

The bootstrap method developed by Preacher &Hayes (2004, 2008) is a non-parametric resampling test. The main feature of this test is that it does not rely on the assumption of normality, and is thus also fit for smaller sample sizes (Hair et al., 2014; Pardo & Roman, 2013). This test has an advantage over Sobel's test, and can help determine the mediation effect with certainty. In this approach, bootstrapping can be used twice: first without the presence of mediation, and secondly, with the presence of mediation. It should be noted that if the direct path is not significant, there is no mediating effect (Wong, 2015; Hair et al., 2014).

3.3.1 Guidelines for mediation analysis in PLS-SEM proposed by Hair et al. (2014):

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According to the guidelines, we evaluate the significance of direct path: in our example, of perceived value → customer loyalty, and service quality → customer loyalty (Figure 3). If the direct effect is not significant, there is no mediation. If the direct path is significant, we include the mediating variable and use the bootstrapping procedure again. If the indirect path is not significant after bootstrapping, there is no mediation; if it is significant, we calculate the *variance accounted for* (VAF). According to Hair et al. (2014), a VAF value of greater than 80% is full mediation, a value between 20% and 80% is partial mediation, and a value less than 20% means there is no mediation.[4]

4 EXAMPLE OF MEDIATION ANALYSIS IN PLS-SEM

In this example we have four constructs: perceived value (PV), service quality (SQ), customer satisfaction (CS), and customer loyalty (CL).Based on existing literature and on logic, customer satisfaction has been modelled as a mediator in answering the research question of whether it mediates the relationships between perceived value and customer loyalty, and between service quality and customer loyalty.

4.1 Evaluation of Measurement Models

The model specified in this study has four constructs with reflective measurement models. We need estimates between their latent and manifest variables. The outer loadings of all items used in this study are accepted. Table 1 reveals that the composite reliability value is 0.882for perceived value, 0.892for service quality, 0.882for customer satisfaction, and 0.911for customer loyalty. This finding demonstrates that all four variables have a satisfactory (above 0.70) level of internal consistency reliability. In this example, the average variance extracted value is 0.6 for perceived value, 0.652 for service quality, 0.538 for customer satisfaction, and 0.720 for customer loyalty. Since all values are above 0.5, the measures used in this study have a high level of convergent validity.

Table 1: Measurement models for customer loyalty

Construct	Standardize loadings	alpha	CR	AVE
Perceived Value				
PV1	0.737			
PV2	0.806			
PV3	0.808			
PV4	0.731	0.833	0.882	0.600
PV5	0.788			
Responsiveness				
RS1	0.727			
RS2	0.869	0.885	0.916	0.686
RS3	0.858			
RS4	0.833			
RS5	0.847			

[4]The variance accounted for (VAF) would be less than 20% when the indirect effect is significant but still very small. Therefore, it can be said that there is no mediation (Hair et al., 2014).

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Reliability				
RL1	0.729	0.845	0.890	0.618
RL2	0.777			
RL3	0.768			
RL4	0.830			
RL5	0.821			
Service quality (HCM)		0.886	0.892	0..652[5]
Customer satisfaction				
TS1	0.785			
TS2	0.778		0.882	0.538
TS5	0.652			
TS7	0.711	0.711		
Customer Loyalty				
CL2	0.759	0.869	0.911	0.720
CL4	0.879			
CL5	0.838			
CL6	0.907			

Source: Own survey

Discriminant validity was assessed via the Fornel-Lacker criterion. Table 2 shows that the square root of AVE of reflective construct customer loyalty, customer satisfaction, perceived value, and service quality is larger than the corresponding latent variables correlations (LVC).

Table 2 Discriminant Validity

Construct	***Customer loyalty***	***Customer Satisfaction***	***Perceived Value***	***Services Quality***
Customer loyalty	**0.849**	---		
Customer Satisfaction	0.847	**0.733**	---	
Perceived Value	0.614	0.625	**0.774**	---
Service Quality	0.576	0.558	0.697	**0.675**

Source: Own survey results

4.2 Evaluation of the structural model

We have seen from the measurement models how the constructs measures used in this study are reliable and valid. The next step in PLS-SEM is an evaluation of the structural model before moving on it is important to examine the level of collinearity in the structural model (Hair et al., 2014). Since the βs of independent variables might be biased due to a high level of collinearity among predictor constructs, we need to examine collinearity when inspecting the structural model. Since SmartPLS does not generate VIF and tolerance values, SPSS was used for collinearity assessment.

Table 3Assessment of multicollinearity

[5]AVE of responsiveness + AVE of reliability / 2.
686+.618/2 = .652

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Customer loyalty as dependent variable			***Customer satisfaction as dependent variable***		
Constructs	Tolerance	VIF	Constructs	Tolerance	VIF
Perceived value	.470	1.6	Service quality	.548	1.824
Service quality	.558	2.1	Perceived value	.548	1.824
Customer satisfaction	.589	1.9	--		

Source: Own survey results

Table 3 indicates that there are no multicollinearity problems, as the values of tolerance are above the 0.2 threshold, and all values of VIF are below the threshold of5.

4.3. Path Coefficient

The coefficients of direct and indirect paths reveal that the structural model relationship is statistically significant (Table 5).

4.4. Coefficient of Determination (R^2)

The coefficient of determination (R^2) value is a common measure on the basis of which the structural model is evaluated. This coefficient represents the combined effects of all independent variables on dependent variables. The R^2value for the overall model here is strong (73.3%), whereas service quality together with perceived value explains 42.2% of the variance on customer satisfaction (Table 7).

4.5 Predictive Relevance (Q^2)

The results in Table 7 indicate that the model is highly predictive, as the value of predictive relevance is above the threshold[6] of zero (Chin, 1988).

4.6 f^2 effect size

The effect size[7] of customer satisfaction on customer loyalty R^2 value is large, whereas the effect size of service quality and perceived value on customer satisfaction R^2 value is low (Table 8).

4.7 q^2 effect size

The effect size of the predictive relevance of customer satisfaction to the endogenous latent variable is large, whereas the effect size of service quality and perceived value on customer loyalty and customer satisfaction is medium and low[8] (Table 8).

5 CUSTOMER SATISFACTION AS A MEDIATIOR

To start with, the path model was estimated via bootstrapping, without the interaction of a mediator (Figure 3). The results reveal that both direct paths are statistically significant. Therefore, inclusion of customer satisfaction as a mediator is meaningful. We require the

[6]Q2 for customer satisfaction is 0.156, and 0.467 for customer loyalty.
[7]$f^2 = R^2_{included} - R^2_{excluded}/1 - R^2_{included}$
[8]Guideline for f^2 *and q2* effect size: 0.02, 0.15, and 0.35, representing small, medium, and large effect

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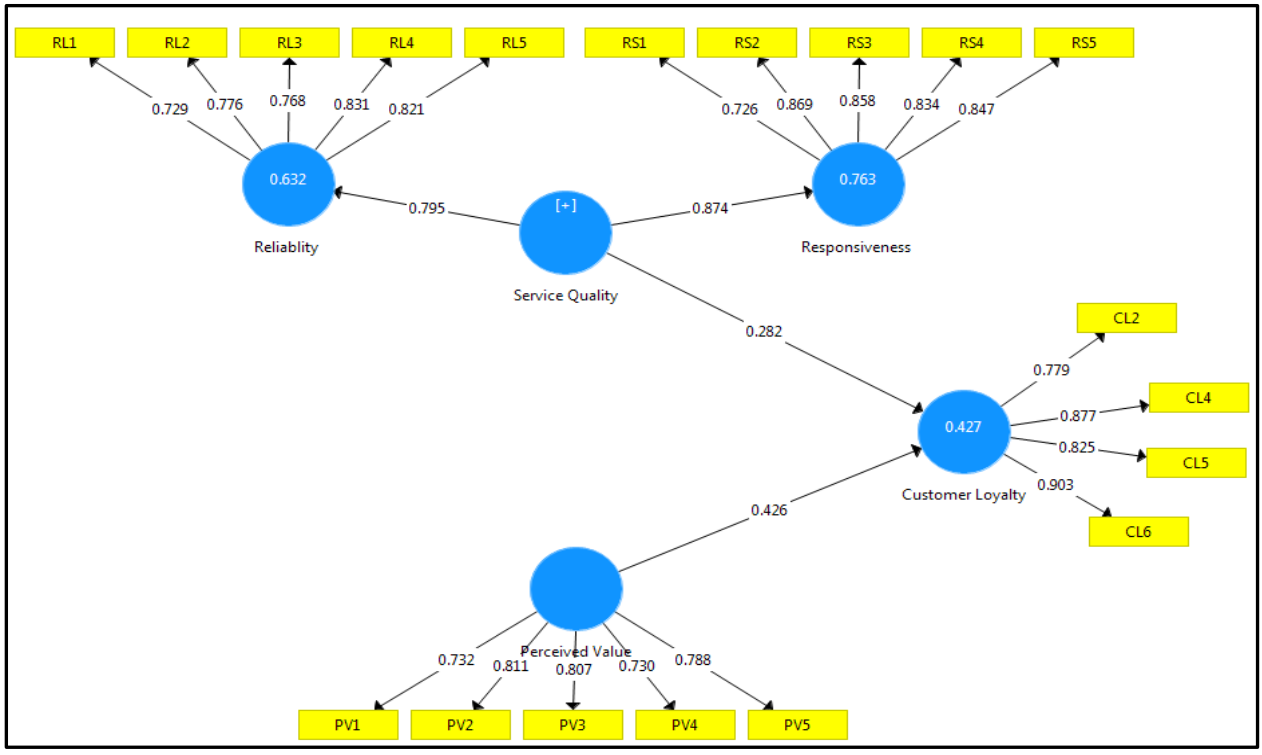
significance of indirect paths in order to verify that customer satisfaction mediates the relationship between perceived value and customer loyalty, and between service quality and customer loyalty. To ascertain the significance of these indirect paths, the samples table from bootstrapping was copied and pasted into MS Excel. Here we computed the value of standard deviation[9], in order to obtain the t value of the indirect paths. The t value of the indirect path (PV → CS → CL) is 0.3387 / 0.091878 = 3.686, with a p value of 0.0004. It can be concluded that customer satisfaction mediates the relationship between perceived value and customer loyalty. The t value of the indirect path (SQ → CS → CL) is = 0.17564 / 0.09917 = 1.7711, with a p value of 0.080, significant at 10% (Table, 6).

Finally, it is important to find out the strength of mediation. The strength of mediation is computed via variance accounted for[10] (VAF), as suggested by Hair et al. (2014).Table 6 reveals that 81.8%of the effect of perceived value on customer loyalty is explained via customer satisfaction. Since the value of VAF is larger than 80%, we can assume customer satisfaction as a full mediator. Table 6 also shows that 61% of the effect of service quality on customer loyalty is explained via customer satisfaction. Since the value of VAF is between 20% and 80%, customer satisfaction partially mediates the relationship between service quality and customer loyalty.

Direct effects



Source: Own survey results. Figure, 3

Table 4 Direct effects

[9]Standard deviation equals the standard error in bootstrapping (Hair et al. 2014).
[10]VAF = indirect effect / total effect * 100

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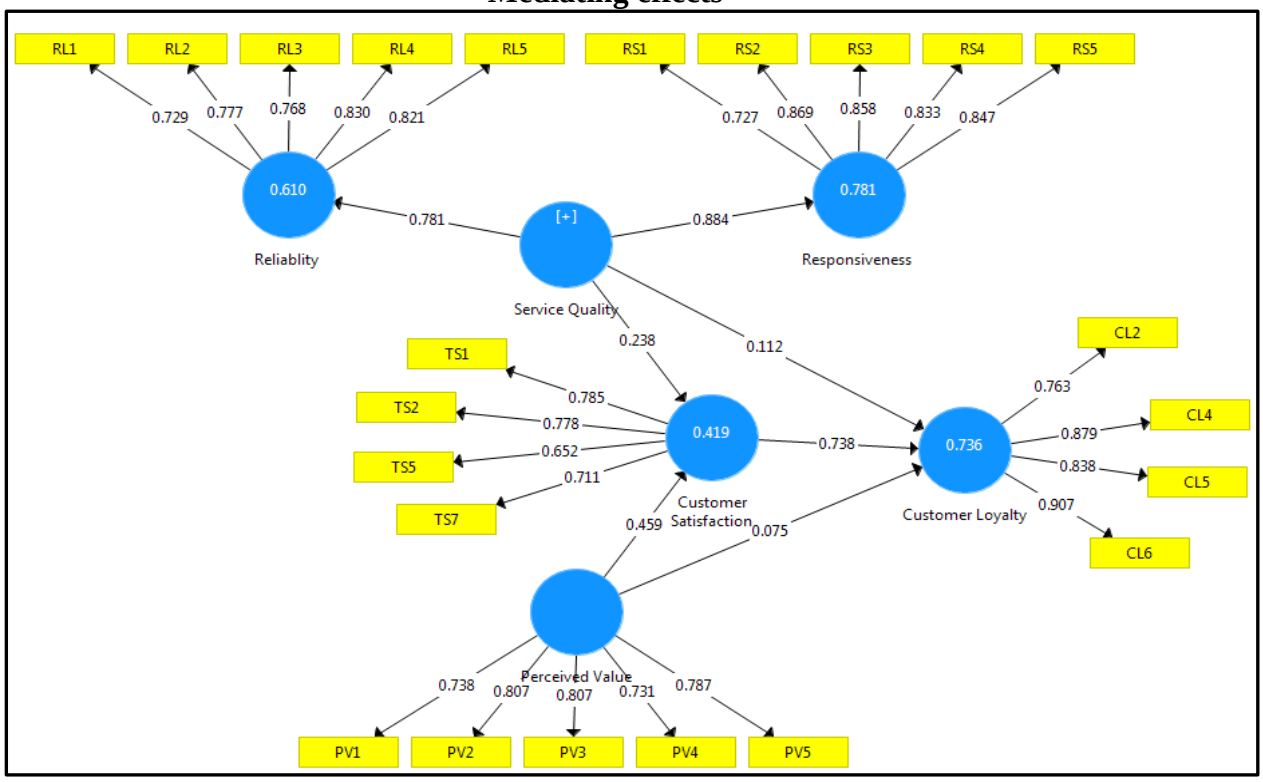
Path	*B*	Std Error	t values	p values	Decision
PV → CL	0.436	0.129	3.302	0.001	Accepted
SQ → CL	0.282	0.137	2.065	0.039	Accepted

Source: Own survey results

Mediating effects



Source: Own survey results. Figure, 4

Table 5Mediating effects

Path	*B*	Std Error	t statistics	p values	Decision
CS → CL	0.738	0.055	13.331	0.000	Accepted
PV → CL	0.075	0.078	0.961	0.337	Rejected
PV → CS	0.459	0.126	3.654	0.000	Accepted
SQ → CL	0.112	0.078	1.435	0.152	Rejected
SQ → CS	0.238	0.133	1.795	0.073	Accepted[11]

Source: Own survey results

[11] At 10% level of significant

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Table 6 Mediation analysis in PLS-SEM

Effects	Path	Path coefficient	Indirect effect	Standard deviation	Total effect	VAF	t values	P value	Decision
Direct without mediator	P V→ CL	0.435	Not applicable				3.302	0.001	Accepted
Indirect with mediator	PV → CL	0.075	Not applicable						
	PV → CS	0.459	0.3387	0.09187	0.4137	81.87%[12]	3.686[13]	0.0004	Accepted
	CS →CL	0.738							
Direct without mediator	SQ → CL	0.268	Not applicable				2.065	0.039	Accepted
Indirect with mediator	SQ → CL	0.112	Not applicable						
	SQ → CS	0.238	0.17564	0.09917	0.2876	61%[14]	1.771[15]	0.080	Accepted
	CS → CL	0.738							

Source: Own survey results

Table 7 R^2 and Q^2 value

Endogenous LVs	***R^2 value***	***Q^2value***
Customer loyalty	0.736	0.502
Customer satisfaction	0.422	0.209

Source: Own survey results

Table 8 f^2 andq^2effect sizes

Constructs	***Customer loyalty***			***Customer Satisfaction***		
	B	f^2	q^2	*B*	f^2	q^2
Service quality	0.112	0.022[16]	-0.006	0.282	0.046[19]	0.016
Perceived value	0.075	0.015[17]	-0.008	0.426	0.192[20]	0.07
Customer satisfaction	0.738	1.17[18]	0.4538	-	-	-

Source: Primary Data

[12]Perceived value and customer loyalty
Indirect effect 0.459 * 0.738 = 0.3387
Total effect = indirect effect + direct effect = 0.3387 + 0.075 = 0.4137.
VAF = indirect effect / total effect * 100 = 0.3387 / 0.4137 * 100 = 81.8%

[13]**Indirect path (PV→ CS → CL) t value**
t value = indirect effect / standard deviation
= 0.3387 / 0.091878 = 3.686

[14]Services quality and customer loyalty
Indirect effect = 0.238 * 0.738 = 0.17564
Total effect = indirect effect + direct effect = 0.17564 + 0.112 = 0.2876.
VAF = indirect effect / total effect * 100 = 0.1756 / 0.2876 * 100 = 61%

[15]**Indirect path (SQ → CS → CL) t value**
t value = indirect effect / standard deviation
= 0.17564 / 0.09917 = 1.7711

[16]$f^2 = R2_{included} - R^2_{excluded}/1 - R^2_{included}$
f^2 = 0.736 - 0.730/1 -0.736 = 0.006 / 0.264
f^2 = 0.022

[17]$f^2 = R^2_{included} - R^2_{excluded}/1 - R^2_{included}$
f^2 = 0.736 - 0.732/1 -0.736 = 0.004 / 0.264
f^2 = 0.015

[18]$f^2 = R2_{included} - R^2_{excluded}/1 - R^2_{included}$
f^2 = 0.736 - 0.427/1 -0.736 = 0.309 / 0.264
f^2 = 1.17

[19]$f^2 = R^2_{included} - R^2_{excluded}/1 - R^2_{included}$
f^2 = 0.422- 0.395/1 -0.422 = 0. 027/ 0.578
f^2 = 0.046

[20]$f^2 = R2_{included} - R^2_{excluded}/1 - R^2_{included}$
f^2 = 0.422- 0.311/1 -0.422 = 0. 111/ 0.578
f^2 = 0.192

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6 CONCLUSION

In order to comprehend the nature of mediation analysis, in this critical review a mediation model was theoretically discussed and practically elaborated via illustrative example. Results from step 1 showed the significance of the direct path. The significant of indirect paths was found in step 2. In the final step of the bootstrap method, it was found that 81.8% of the effect of perceived value on customer loyalty is explained via customer satisfaction. In view of this, it can be assumed that customer satisfaction fully mediates the relationship between perceived value and customer loyalty. The mediating effect of customer satisfaction between service quality and customer loyalty was found to be partial. Hence, it can be concluded that customer loyalty can be strengthened and enhanced by raising the level of customer satisfaction.

Meanwhile, from methodological assumption, it can be concluded from the findings that comparatively the bootstrap procedure by Preachers and Hayes (2004, 2008), fully supported by Hair et al. (2014) is a powerful tool for mediation analysis. Also, this procedure is made more effective by means of PLS-SEM with the application of SmartPLS. Therefore, we strongly suggest this technique for mediation analysis. As for as the evaluation of measurement models and structural model is concern, researchers must look at reliability, construct validity (convergent and discriminant), collinearity, path coefficients, coefficient of determination R^2, predictive relevance Q^2, and effect sizes $f^2$and q^2.

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