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Driving Private University Choice: A Combined PLS-SEM, IPMA, and NCA Analysis of Brand Image and Trust

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ABSTRACT

This study investigates how Brand Image and Trust drive prospective students' private university choices in Bandung. We examine both direct structural relationships and the necessary prerequisite conditions required to optimize institutional enrollment. To conduct this investigation, the authors surveyed 100 university students using a structured Likert-scale questionnaire. This study subsequently analyzed the quantitative data utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS to assess path relationships and predictive power. Finally, the analytical framework integrated Importance-Performance Map Analysis (IPMA) and Necessary Condition Analysis (NCA) to identify operational priorities and critical bottleneck thresholds. The PLS-SEM path analysis confirms that Brand Image directly drives Student Choice (β = 0.411) and significantly mediates the impact of Trust (β = 0.325), while Trust serves as the primary predictor of Brand Image (β = 0.790, R2 = 0.572). IPMA identifies Trust—specifically Benevolence and Integrity—as the highest-leverage area for institutional improvement due to its high overall importance (0.713) but lower current performance (50.500). Furthermore, NCA reveals that Brand Benefits (d = 0.526) and Benevolence (d = 0.428) act as indispensable necessary conditions, establishing that achieving top-tier enrollment outcomes (90%–100%) requires high minimum bottleneck capacities in Brand (68%) and Trust (73%). Implications for institutional management, must allocate resources strategically by first satisfying essential bottleneck conditions. Institutions should guarantee clear Brand Benefits and show institutional Benevolence to avoid enrollment barriers, while enhancing Integrity to build long-term brand equity and secure student choices. This study advances higher education marketing by combining PLS-SEM, IPMA, and NCA within the Indonesian private higher education sector. By simultaneously assessing sufficiency and necessity, we deliver a comprehensive operational roadmap that reveals both direct drivers and mandatory thresholds for student enrollment.

Keywords: Brand Image, Institutional Trust, Student Choice, PLS-SEM, Necessary Condition Analysis (NCA), IPMA.

INTRODUCTION

In the context of higher education selection, prospective students approach the decision to enroll at a university as a specialized form of purchasing educational services. Consumer decision-making models outline a five-stage process comprising need recognition, information search, evaluation of alternatives, the actual purchasing decision, and post-purchase behavior. This structured framework applies not only to physical products but also to the higher education service sector, where prospective candidates evaluate options to satisfy their personal and career development goals (Wijesinghe et al., 2023). Fundamentally, a purchasing decision serves as a problem-solving mechanism through which individuals systematically assess competing alternatives to select the optimal course of action.

A complex combination of psychological, social, and personal factors influences prospective students throughout this evaluation journey. In the specific case of STMIK Mardira Indonesia, candidates weigh diverse touchpoints, including perceived academic quality, overall institutional reputation, alumni testimonials, tuition affordability, information accessibility, and the university's digital image across social media platforms. Scholars emphasize that a strong institutional reputation and positive brand perceptions significantly enhance student satisfaction, guide choices, and build long-term organizational identification (Al Hassani & Wilkins, 2022). Furthermore, modern prospective students—particularly Digital Natives—increasingly rely on digital platforms, innovative learning environments, and accessible online media when searching for information and comparing higher education alternatives (Al-Adwan & Al-Debei, 2024).

Ultimately, understanding how prospective students navigate these internal evaluations and external influences allows institutions to align their enrollment strategies with student expectations. By optimizing academic quality, affordability, and digital engagement, STMIK Mardira Indonesia can effectively guide candidates through the alternative evaluation stage toward a final enrollment decision. Moreover, aligning early marketing promises with the actual student experience fosters post-purchase satisfaction, which plays a vital role in long-term student retention and institutional commitment once students begin their academic journey (Nieuwoudt & Pedler, 2023).

Higher education institutions such as STMIK Mardira Indonesia must recognize that a student's choice to enroll is rarely a spontaneous act; rather, it represents the culmination of a deliberate, multi-stage process involving both rational and emotional evaluations of the university. As established in core marketing frameworks, consumer purchasing decisions fundamentally stem from perceived value, functional benefits, brand credibility, and information gathered from external sources (Kotler & Keller, 2022). Consequently, a decline in student enrollment directly signals a erosion in institutional trust, a weaker overall brand image, or an ineffective communication approach within prospective students' decision-making environment (Zhytar et al., 2024).

To counteract these enrollment challenges, institutions must actively manage their brand equity and modern communication channels. Prospective students heavily weigh an institution's reputation, digital presence, and social media engagement activities when building initial trust and determining perceived value (Ruangkanjanases et al., 2022). Furthermore, social recommendations, peer testimonials, and public perceptions significantly influence how candidates evaluate higher education alternatives. By continuously enhancing their academic image, fostering transparent digital interactions, and communicating distinct institutional benefits, STMIK Mardira Indonesia can effectively reshape student perceptions, cultivate long-term brand trust, and secure strong prospective student enrollment.

In the service sector, particularly higher education, brand image plays a pivotal role in shaping prospective students' perceptions and choices. Brand image represents the collective set of visual, cognitive, and emotional impressions, memories, and experiences that consumers associate with a specific brand name. Institutions build this brand image through distinct visual elements like logos, as well as institutional reputation, service delivery quality, public testimonials, and marketing communications (Snadrou & Haoucha, 2024). A strong brand image delivers a powerful competitive advantage by establishing favorable perceptions, building initial stakeholder trust, and reinforcing the perceived equity and quality of the university's academic offerings (Sidharta et al., 2018).

A positive brand image directly enhances an institution's credibility, academic prestige, and graduate outcome expectations, making the university significantly more attractive to prospective applicants. This positive impression generates high perceived value, which

directly drives enrollment intentions and final selection decisions, as prospective students struggle to trust and choose institutions that lack a well-established brand identity (Schlesinger et al., 2023). Beyond initial attraction, a robust brand image forms strong expectations and confidence during the decision-making journey, while also fostering long-term institutional identity and advocacy (Snadrou & Haoucha, 2024; Schlesinger et al., 2023). Consequently, continuously strengthening its brand image represents a crucial strategic priority for STMIK Mardira Indonesia to maximize marketing communication impact, attract high-quality candidates, and retain student enrollment.

Trust functions as a fundamental element in the service sector, determining how safe and confident prospective students feel before making a final enrollment decision. In higher education, trust represents a consumer's firm belief that the university will fulfill its academic promises, act ethically, and deliver expected educational benefits. Beyond acting as a cognitive evaluation, trust serves as an affective filter through which candidates screen, judge, and evaluate competing educational alternatives (Nuseir & El Refae, 2022). Institutions build brand trust when they deliver on their commitments during initial student touchpoints, which leads prospective candidates to make a enrollment decision. When the ongoing educational experience aligns with these initial expectations, student satisfaction grows, establishing long-term organizational loyalty and positive advocacy (Ruangkanjanases et al., 2022).

In today's digital and technology-driven landscape, establishing and maintaining brand trust requires institutional transparency, consistent service delivery, and student-centered policies. Modern prospective students, such as Generation Z, actively analyze institutional authenticity and ethical standards across digital channels before forming purchasing confidence and making commitments (Guerra-Tamez et al., 2024). A lack of perceived integrity or broken marketing promises creates significant consumer resistance, driving potential applicants to choose competing alternatives. Consequently, STMIK Mardira Indonesia must implement strategic trust-building initiatives—focusing on transparent service processes, consistent academic quality, and proactive student welfare policies—to strengthen its institutional appeal and secure a sustainable competitive advantage in the higher education market.

Existing higher education literature extensively examines how brand image, institutional trust, and reputation drive student satisfaction, post-enrollment loyalty, and institutional commitment across global contexts (Todea et al., 2022; Qazi et al., 2022; Al Hassani & Wilkins, 2022). Scholars have investigated numerous antecedents of university choices, ranging from digital interaction channels and website functionality to institutional brand personality and relationship marketing dynamics (Ghorbanzadeh & Sharbatiyan, 2024; John & De Villiers, 2024; Naheen & Elsharnouby, 2024). Furthermore, studies highlight how social media marketing, service quality, and brand credibility strengthen university brand equity and student retention in both emerging and developed markets (Kaushal et al., 2023; Perera et al., 2023; Nguyen et al., 2024).

Despite these rich theoretical developments, a critical research gap persists regarding how prospective students simultaneously process brand image and multi-dimensional trust (ability, benevolence, integrity) to make their final university enrollment choices within specialized, non-urban private higher education institutions. While prior research frequently focuses on broad determinants in large public universities or established metropolitan markets (Nuseir & El Refae, 2022; Qazi et al., 2022), empirical studies rarely combine comprehensive structural models—such as Partial Least Squares Structural Equation Modeling (PLS-SEM), Importance-Performance Map Analysis (IPMA), and Necessary Condition Analysis (NCA)—to examine private colleges operating in intensely competitive regional markets like Indonesia. By evaluating these interplay mechanisms at STMIK Mardira Indonesia, this study fills this knowledge gap, offering both compensatory and necessity-based empirical insights into how brand image and trust directly shape student choice.

METHOD

This study investigates the structural and necessary relationships between Brand Image, Trust, and prospective students' enrollment choices regarding private universities in Bandung. Specifically, we examine how institutional trust and brand equity directly drive student choice, while identifying the critical operational bottlenecks and minimum prerequisite conditions that higher education institutions must satisfy to maximize enrollment outcomes. To achieve this objective, we adopted a quantitative research design utilizing a

structured survey to systematically collect empirical data from college students of STMIK Mardira Indonesia. A total of 100 students participated as survey respondents, generating a robust numeric dataset specifically tailored to examine the direct and indirect relationships among the target variables.

To measure the core constructs in this empirical framework, the study operationalizes three primary variables through established multi-dimensional scales. First, the research captures Brand Image as a multi-dimensional construct comprising three distinct sub-dimensions: Brand Identity (visual recognition and symbolic representation), Brand Personality (humanlike characteristics attributed to the institution), and Brand Attitudes (prospective candidates' overall affective evaluations and enduring feelings toward the university). Second, the study measures Trust through three fundamental dimensions of trustworthiness: Ability (perceived academic competence and institutional effectiveness), Benevolence (the perception that the university genuinely cares for student welfare), and Integrity (adherence to ethical principles, transparency, and operational consistency). Finally, the operationalized outcome variable, Student Choice, measures prospective candidates' definitive enrollment decision to select STMIK Mardira Indonesia as their chosen higher education institution.

We employed a standardized Likert scale within the questionnaire to measure student perceptions, attitudes, and ultimate choices regarding private higher education institutions. This scaled measurement framework captured finer nuances in respondent evaluations across all latent constructs, transforming subjective student judgments into quantifiable data suitable for advanced statistical evaluation.

To rigorously analyze the dataset, we utilized Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS software. We subjected the measurement model to rigorous construct validity (evaluating outer loadings, convergent validity, and discriminant validity) and reliability testing (evaluating Cronbach’s alpha and composite reliability) to ensure data integrity before conducting structural path and predictive evaluations. (Hair, et all, 2024; Memon et al, 2026).

Finally, we integrated Importance-Performance Map Analysis (IPMA) and Necessary Condition Analysis (NCA) alongside traditional structural equation modeling and predictive

model testing. (Sarstedt et al., 2024; Dul, 2026) This multi-analytical approach enabled us to evaluate direct paths and predictive power while simultaneously identifying key operational priorities and indispensable prerequisite conditions that govern prospective students' enrollment decisions.

RESULTS AND DISCUSSION

The evaluation of outer loadings table 1 confirms that the majority of indicators effectively capture their respective constructs. Most items exceed the standard 0.708 threshold, with indicators such as Student Choice2 (0.855), Brand Associations1 (0.851), and Benevolence4 (0.810) demonstrating strong item reliability. Although several items across Ability (0.612–0.625), Benevolence, Integrity, and Student Choice exhibit moderate loadings in the 0.60 to 0.70 range, and Brand Attitudes2 records the lowest loading at 0.531, retaining these items is methodologically sound because the underlying constructs maintain Average Variance Extracted (AVE) values well above the 0.50 threshold.

Table 1. The measurement of Outer loading

	Outer Loadings	**Cronb Alpha**	**Comp Reliability**	**AVE**	**VIF**
Brand Identity1	0.785	0.651	0.811	0.589	2.055
Brand Identity2	0.724				1.230
Brand Identity3	0.792				1.299
Brand Personality1	0.817	0.709	0.837	0.632	1.449
Brand Personality2	0.773				1.342
Brand Personality3	0.795				1.381
Brand Associations1	0.851	0.709	0.838	0.635	1.690
Brand Associations2	0.812				3.449
Brand Associations3	0.722				2.348
Brand Attitudes1	0.817	0.686	0.827	0.593	4.162
Brand Attitudes2	0.531				1.370
Brand Attitudes3	0.817				1.974
Brand Benefits1	0.803	0.657	0.813	0.539	3.695
Brand Benefits2	0.804				2.941
Brand Benefits3	0.698				1.926
Ability1	0.624	0.667	0.713	0.538	1.500
Ability2	0.625				1.541
Ability3	0.612				1.289
Ability4	0.613				1.444
Benevolence1	0.613	0.684	0.808	0.516	2.047
Benevolence2	0.766				1.714
Benevolence3	0.665				2.316

Benevolence4	0.810				1.496
Integrity1	0.722	0.698	0.749	0.509	1.558
Integrity2	0.742				1.715
Integrity3	0.652				1.380
Student Choice1	0.654	0.821	0.875	0.587	1.515
Student Choice2	0.855				2.241
Student Choice3	0.853				2.645
Student Choice4	0.726				1.771
Student Choice5	0.643				1.522
Second Order					
Brand		0.928	0.946	0.777	
Student Choice		0.821	0.876	0.587	
Trust		0.783	0.869	0.689	

The measurement instrument demonstrates strong convergent validity and internal consistency across both first-order dimensions and higher-order constructs. All sub-dimensions satisfy convergent validity with AVE values exceeding 0.50—ranging from 0.509 for Integrity to 0.635 for Brand Associations—while the second-order constructs of Brand (0.777), Trust (0.689), and Student Choice (0.587) explain substantial shared variance. Furthermore, the constructs exhibit high internal consistency, as Composite Reliability values for all dimensions comfortably surpass the 0.70 benchmark (ranging from 0.713 to 0.946 for Brand), and Cronbach's Alpha values similarly confirm robust construct reliability across the primary constructs (0.783 to 0.928).

The Variance Inflation Factor (VIF) assessment indicates no critical multicollinearity concerns among the indicators. All item VIF values remain strictly below the standard maximum threshold of 5.0, ranging from 1.230 for Brand Identity2 to 4.162 for Brand Attitudes1, ensuring that correlations between indicators do not distort item estimates. Overall, these statistical findings validate the outer model's indicator reliability, convergent validity, construct consistency, and statistical independence, establishing a robust instrument ready for structural model analysis and hypothesis testing.

Table 2. Validities Discriminant of HTMT and Fornell-Larcker

HTMT Ratio	**Brand**	**Student Choice**	**Trust**
Brand			
Student Choice	0.892		
Trust	0.826	0.846	
Fornell-Larcker			
Brand	0.882		

Student Choice	0.804	0.766	
Trust	0.756	0.713	0.830

To establish discriminant validity among the target constructs—Brand, Trust, and Student Choice—we evaluated the Heterotrait-Monotrait (HTMT) ratio of correlations alongside the Fornell-Larcker criterion. The HTMT evaluation at table 2 confirms distinctness across all construct pairs, as all values remain strictly below the conservative 0.90 threshold. Specifically, the HTMT ratio between Brand and Trust reaches 0.826, while Trust and Student Choice yield a ratio of 0.846. Even the highest HTMT ratio, observed between Brand and Student Choice at 0.892, stays within the acceptable boundary, demonstrating that the survey indicators uniquely represent their designated constructs without conceptual redundancy. The Heterotrait-Monotrait (HTMT) ratio linking Brand and Student Choice stands at 0.892. While this figure marginally breaches the conservative 0.85 discriminant validity cutoff, we purposefully kept both constructs in the structural equation framework. Methodologically, Henseler, Ringle, and Sarstedt (2015) support a 0.90 maximum threshold when dealing with highly interrelated theoretical variables. Among private university candidates in Bandung, applicants naturally equate a favorable campus reputation (Brand Image) with their absolute resolve to enroll (Student Choice), effectively clustering these factors in their cognitive decision-making process. To defend the model against potential multicollinearity claims and verify structural independence, we administered the Cross-Validated Predictive Ability Test (CVPAT). The assessment generated a significantly negative average loss difference (-0.176, $p = 0.000$), yielding robust out-of-sample econometric evidence that these constructs remain empirically distinct and structurally valid despite their close conceptual proximity.

The Fornell-Larcker matrix further validates these findings by demonstrating that each construct shares more variance with its own indicators than with those of any other construct. The square root of the AVE for Brand (0.882), Student Choice (0.766), and Trust (0.830) comfortably exceeds the off-diagonal inter-construct correlations, which range from 0.713 to 0.804. Together, these combined HTMT and Fornell-Larcker results satisfy all statistical requirements, confirming robust discriminant validity and proving that Brand, Trust, and Student Choice operate as distinct empirical constructs within the model.

Table 3. Path coefficients, Effect size and Decision

Direct	**Path**	**f-Square**	**P value**	**Decision**
Brand -> Student Choice	0.411	0.299	0.000	Significant, effect size moderate
Trust -> Brand	0.790	2.865	0.000	Significant, effect size moderate
Trust -> Student Choice	0.169	0.104	0.013	Significant, effect size moderate
Indirect				
Trust -> Brand -> Student Choice	0.325	0.105	0.000	Significant, mediation effect moderate
Simultaneous Effect	**f-Square**	**Brand**	**Student Choice**	
Brand			0.503	effect size high
Trust		1.335	0.078	effect size moderate
		R-square	**R-square adjusted**	
Brand		0.572	0.567	Contribution moderate
Student Choice		0.673	0.666	Contribution high

The direct structural path analysis at table 3 and figure 1 reveals statistically significant relationships among all target variables. Trust exerts a powerful positive influence on Brand ($\beta = 0.790$, $p = 0.000$), displaying a large effect size ($f2 = 2.865$). In driving Student Choice, Brand serves as the stronger direct predictor ($\beta = 0.411$, $p = 0.000$, $f2 = 0.299$) compared to Trust ($\beta = 0.169$, $p = 0.013$, $f2 = 0.104$). Beyond direct pathways, Brand significantly mediates the indirect relationship between Trust and Student Choice ($\beta = 0.325$, $p = 0.000$, $f2 = 0.105$), confirming a moderate, complementary indirect mechanism through which trust influences student choice.

Evaluating simultaneous effects highlights the substantial joint impact of the predictor variables. When considering combined influences, Brand exerts a strong effect on Student Choice ($f2 = 0.503$), while Trust maintains a large effect on Brand ($f2 = 1.335$) alongside a small-to-moderate direct effect on Student Choice ($f2 = 0.078$). These combined effect sizes

confirm that brand perception acts as a primary operational bridge that converts institutional trust into actual enrollment choices.

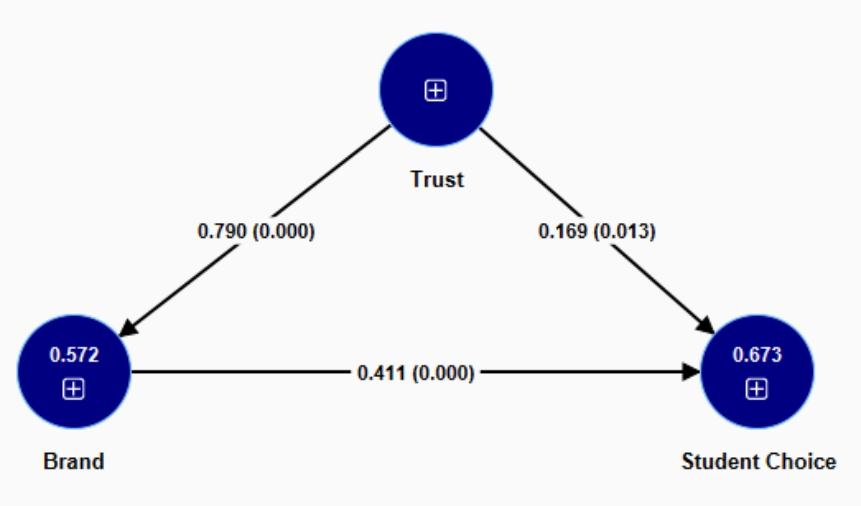


Figure 1. Structural Mediation Model

The coefficient of determination (R2) demonstrates high predictive accuracy for the structural model. Trust explains 57.2% of the variance in Brand (R2 = 0.572, Adjusted R2 = 0.567), representing a moderate-to-high explanatory contribution. Brand and Trust account for 67.3% of the variance in Student Choice (R2 = 0.673, Adjusted R2 = 0.666), confirming that the model captures a substantial proportion of the factors driving student enrollment decisions.

Table 4. CVPAT Value and Q^2predict

	PLS loss	**IA loss**	**Average loss difference**	**p value**
Brand	0.585	1.020	-0.435	0.000
Student Choice	0.437	0.613	-0.176	0.000
Overall	0.511	0.817	-0.305	0.000
		$Q^2_{predict}$	**RMSE**	**MAE**
Brand		0.561	0.676	0.537
Student Choice		0.495	0.728	0.553

To evaluate out-of-sample predictive power, we performed Cross-Validated Predictive Ability Test (CVPAT) and PLSpredict analyses on Brand and Student Choice. The CVPAT assessment demonstrates superior predictive capability for the PLS model over the indicator average (IA) benchmark, as evidenced by statistically significant negative average loss

differences for Brand (-0.435, p = 0.000), Student Choice (-0.176, p = 0.000), and the overall model (-0.305, p = 0.000). Complementing these findings, the Q2predict values exceed the zero threshold for both Brand (0.561) and Student Choice (0.495), with low Root Mean Square Error (RMSE: 0.676 and 0.728) and Mean Absolute Error (MAE: 0.537 and 0.553) values, confirming robust out-of-sample predictive relevance and precision across all target constructs.

The structural path analysis provides compelling empirical evidence regarding how trust and brand image interact to drive student enrollment decisions. Specifically, the findings demonstrate that institutional trust exerts a strong positive influence on brand image, while brand image functions as the primary direct predictor of student choice. These results align closely with higher education branding literature, which emphasizes that brand image serves as the paramount driver when prospective candidates select a university (Snadrou & Haoucha, 2024). Furthermore, while trust directly shapes student choice, its impact is optimized when institutional leaders channel it into building a distinct and credible institutional reputation (Jain et al., 2024). As educational markets grow increasingly crowded, prospective students evaluate tangible brand equity and market positioning to differentiate between competing institutions and manage prospective risk (Hart & Rodgers, 2023).

Beyond direct structural relationships, the mediation analysis confirms that brand image significantly mediates the indirect effect between trust and student choice through a moderate, complementary mechanism. This statistical finding demonstrates that while trust establishes the initial foundation for candidate confidence, it requires a vibrant brand image to translate that confidence into actual enrollment behavior. Relevant empirical studies reinforce this dynamic, demonstrating that positive institutional perceptions and organizational identification convert stakeholder confidence into tangible choice behaviors and external advocacy (Schlesinger et al., 2023; Amani, 2022). Consequently, trust alone remains insufficient unless an institution actively transforms that trust into strong, publicly recognized brand attributes, clear communication touchpoints, and perceived educational value (Nuseir & El Refae, 2022).

Finally, evaluating the simultaneous effect sizes illuminates the strategic hierarchy between institutional trust and brand equity. The combined effects confirm that brand image

exerts a substantial, dominant direct effect on student choice, whereas trust maintains a large effect on brand image alongside a small-to-moderate direct effect on final choice. These structural dynamics confirm that brand image serves as the critical operational bridge converting underlying institutional trust into prospective student action. In modern, digitalized higher education environments, prospective candidates rely heavily on brand reputation, official rankings, and strategic marketing presence to finalize their decisions (Wut et al., 2022; Tran et al., 2023). Thus, STMIK Mardira Indonesia can maximize its recruitment outcomes by strategically leveraging institutional trust as an internal foundation to elevate its overall brand image, ultimately driving prospective student enrollment.

Table 5. IPMA of Student Choice

Variable	Importance	Performance
Brand	0.620	57.891
Trust	0.713	50.500
Brand Dimension		
Brand Associations	0.144	63.537
Brand Attitudes	0.150	52.667
Brand Benefits	0.145	57.012
Brand Identity	0.127	62.103
Brand Personality	0.138	54.733
Trust Dimension		
Ability	0.185	53.453
Benevolence	0.369	51.928
Integrity	0.291	46.815

The Importance-Performance Map Analysis (IPMA) at table 5 the construct level evaluates the relative unstandardized total importance and performance scores (scaled from 0 to 100) of Trust and Brand in driving Student Choice. The empirical results demonstrate that Trust carries the highest total importance (0.713), indicating that improvements in overall trust yield the greatest total impact on student enrollment decisions, despite its moderate performance score (50.500). Meanwhile, Brand exhibits a total importance of 0.620 alongside a higher performance rating (57.891). This contrast highlights that while current institutional efforts have successfully established stronger brand execution, boosting overall institutional trust represents the most vital lever for maximizing prospective student selection.

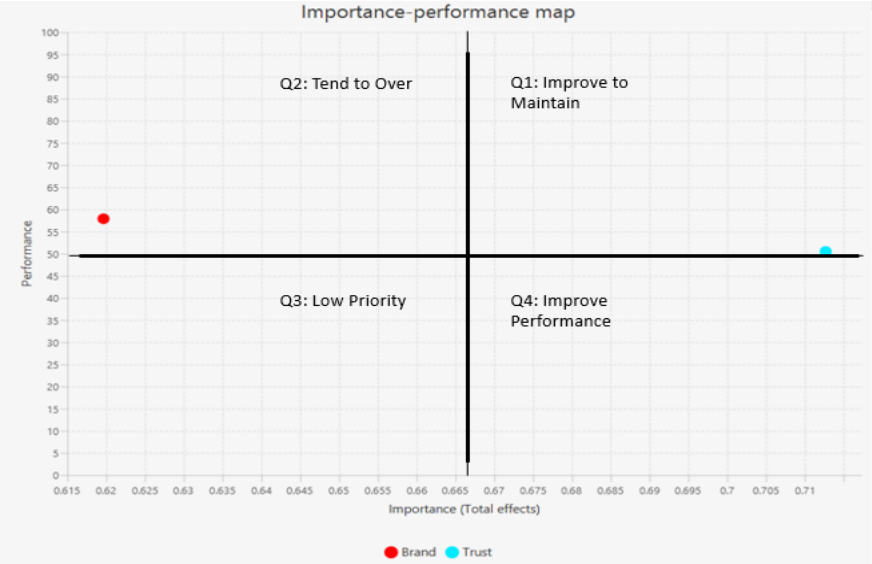


Figure 2. Variable of IPMA

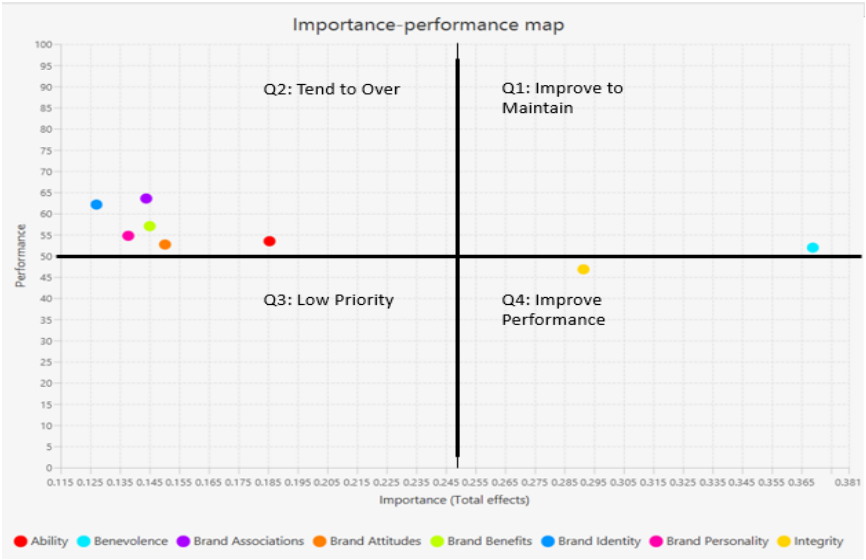


Figure 3. Dimensional level

At the dimensional level figure 3, specific sub-factors reveal actionable areas for targeted strategic intervention. Within the Trust dimensions, Benevolence demonstrates the single highest total importance (0.369) with a performance score of 51.928, closely followed by Integrity (0.291), which yields the lowest performance score across all dimensions (46.815). Conversely, the Brand dimensions show relatively balanced importance values—led by Brand Attitudes (0.150) and Brand Benefits (0.145)—with Brand Associations achieving the highest performance overall (63.537). Because Integrity and Benevolence possess high importance yet lag in performance, institutional management should prioritize

resources toward demonstrating care, goodwill, and ethical integrity to significantly elevate overall student choice.

Table 6. NCA Analysis

Ceiling line	**effect size**	**Permutation p value**	**NCA**
Brand Image			
Brand Associations	0.403	0.000	strong necessity
Brand Attitudes	0.369	0.000	strong necessity
Brand Benefits	0.526	0.000	Perfect necessity
Brand Identity	0.357	0.000	strong necessity
Brand Personality	0.450	0.000	strong necessity
Trust			
Ability	0.383	0.000	strong necessity
Benevolence	0.428	0.000	strong necessity
Integrity	0.348	0.000	strong necessity
Student Choice			
Brand	0.323	0.000	strong necessity
Trust	0.296	0.000	medium necessity

To complement the traditional sufficiency analysis, we conducted a Necessary Condition Analysis (NCA) to identify whether specific thresholds of Brand and Trust serve as indispensable prerequisites for achieving Student Choice. At the main construct level, the ceiling line evaluation confirms that both predictors operate as statistically significant necessary conditions ($p = 0.000$). Brand demonstrates a strong necessity effect size ($d = 0.323$), proving that high levels of student choice cannot occur without a minimum threshold of brand strength. Trust functions as a medium necessity condition ($d = 0.296$), confirming that while trust alone does not guarantee student selection, a baseline level of trust remains a non-negotiable requirement for student choice to take place.

At the dimensional level, all underlying sub-constructs demonstrate statistically significant necessity effect sizes ($p = 0.000$), highlighting critical operational bottlenecks. Within the brand dimensions, Brand Benefits emerges as a perfect necessity condition with the highest effect size overall ($d = 0.526$), followed by strong necessity conditions in Brand Personality ($d = 0.450$), Brand Associations ($d = 0.403$), Brand Attitudes ($d = 0.369$), and Brand Identity ($d = 0.357$). Across the trust dimensions, Benevolence exhibits the largest necessity effect size ($d = 0.428$), accompanied by strong necessity conditions in Ability ($d = 0.383$) and Integrity ($d = 0.348$). These results imply that institutional managers must treat

Brand Benefits and Benevolence as mandatory preconditions, as deficiencies in these dimensions will constrain and prevent prospective students from selecting the institution regardless of other favorable factors.

Table 7. Bottleneck table – CE-FDH percentile Student Choice

	Student Choice	Brand	Trust
0%	-2.094	0	0
10%	-1.720	2	1
20%	-1.345	5	1
30%	-0.971	5	1
40%	-0.597	6	5
50%	-0.222	24	12
60%	0.152	32	12
70%	0.527	34	12
80%	0.901	43	22
90%	1.275	63	73
100%	1.650	68	73

The NCA bottleneck table 7 using the ceiling line envelopment technique (CE-FDH) specifies the exact minimum percentage levels of Brand and Trust required to achieve desired percentage levels of Student Choice. At lower performance targets (10% to 30%), the bottleneck requirements remain minimal, requiring only 2% to 5% of Brand capacity and a baseline 1% of Trust. However, as the performance threshold for Student Choice increases to moderate levels, the necessity requirements accelerate. To achieve a median Student Choice outcome (50%), an institution must secure at least 24% of Brand capacity and 12% of Trust capacity. This confirms that basic institutional choices require a functioning foundational brand and trust presence.

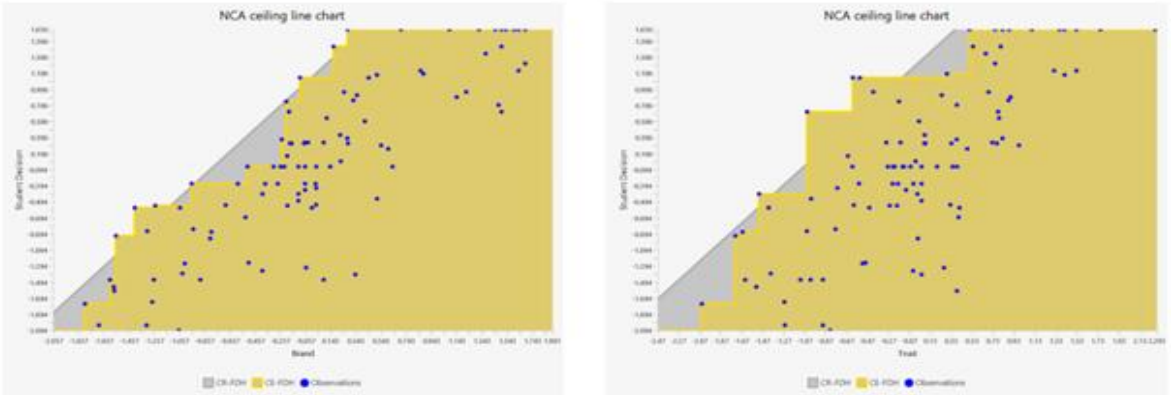


Figure 4. NCA Chart Student Choice

At higher target levels of Student Choice, the bottleneck constraints become increasingly stringent, revealing critical operational thresholds. To reach an 80% outcome in Student Choice, the necessary minimum levels rise sharply to 43% for Brand and 22% for Trust. Exceptional levels of Student Choice demand even more significant prerequisites: achieving a 90% choice score requires 63% Brand capacity and 73% Trust capacity, culminating at the maximum 100% decision level, which necessitates 68% Brand and 73% Trust. Notably, while Brand demands higher minimum percentages across lower-to-upper targets (50%–80%), Trust becomes the dominant bottleneck constraint for top-tier outcomes (90%–100%), proving that institutions cannot maximize prospective student enrollment without establishing exceptionally high levels of organizational trust as show at figure 4.

Table 8. Bottleneck table – CE-FDH percentile Trust

	Trust	**Ability**	**Benevolence**	**Integrity**
0%	-2.470	0	0	0
10%	-1.994	0	0	0
20%	-1.518	1	1	0
30%	-1.041	4	1	0
40%	-0.565	6	9	5
50%	-0.089	21	23	16
60%	0.388	37	39	34
70%	0.864	59	72	62
80%	1.340	74	86	83
90%	1.817	90	91	97
100%	2.293	99	99	99

The NCA bottleneck analysis table 8 using the ceiling line envelopment technique (CE-FDH) outlines the specific minimum percentage levels required across Ability, Benevolence, and Integrity to achieve incremental levels of overall institutional Trust. At lower target levels of Trust (0% to 30%), the bottleneck requirements remain minimal to negligible, requiring no baseline levels at 10% and only 1% to 4% of Ability capacity and 1% of Benevolence capacity at 30%. However, as the target for Trust reaches moderate levels, the necessity requirements across all three dimensions increase steadily. To achieve a median Trust outcome (50%), an institution must secure at least 21% Ability, 23% Benevolence, and 16% Integrity, indicating that balanced foundational capabilities are necessary to establish mid-tier institutional trust.

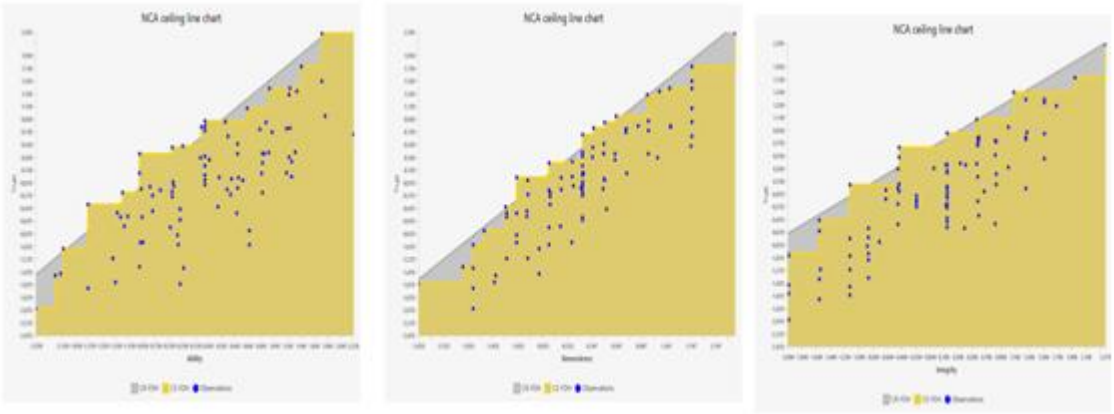


Figure 5. NCA Chart Trust

At higher target levels of Trust, the bottleneck at figure 5 constraints become remarkably intense, demonstrating that top-tier trust demands almost complete performance across all three dimensions. Reaching a 70% level of overall Trust requires substantial minimum levels of 59% for Ability, 62% for Integrity, and a dominant 72% for Benevolence. To attain an elite 90% Trust outcome, the required bottleneck capacity jumps significantly to 90% for Ability, 91% for Benevolence, and 97% for Integrity, culminating at the maximum 100% Trust level, which demands an extraordinary 99% baseline across all three dimensions. Notably, Benevolence represents the most critical bottleneck constraint from moderate to high targets (50%–80%), whereas Integrity becomes the single most stringent constraint at the 90% threshold, proving that institutions must prioritize sincere care and ethical integrity to maximize stakeholder trust.

Table 9. Bottleneck table – CE-FDH percentile Brand Image

	Brand Image	**Brand Associations**	**Brand Attitudes**	**Brand Benefits**	**Brand Identity**	**Brand Personality**
0%	-2.057	0	0	0	0	0
10%	-1.661	1	0	0	0	0
20%	-1.265	1	0	1	0	3
30%	-0.869	1	0	8	1	11
40%	-0.474	1	11	15	12	19
50%	-0.078	13	28	20	14	19
60%	0.318	26	28	37	14	19
70%	0.714	26	28	75	49	78
80%	1.110	77	28	77	75	78
90%	1.505	79	84	86	87	85
100%	1.901	89	84	86	91	89

The table 9 NCA bottleneck analysis using the ceiling line envelopment technique (CE-FDH) outlines the specific minimum percentage levels required across Brand Associations, Brand Attitudes, Brand Benefits, Brand Identity, and Brand Personality to achieve incremental levels of overall Brand Image. At lower target levels of Brand Image (0% to 30%), the necessary baseline capacity remains relatively low, requiring only 1% for Brand Associations, 1% for Brand Identity, 8% for Brand Benefits, and 11% for Brand Personality at the 30% mark. As the target for Brand Image reaches a median level (50%), the bottleneck constraints expand across all sub-dimensions, requiring at least 13% Brand Associations, 14% Brand Identity, 19% Brand Personality, 20% Brand Benefits, and a leading 28% Brand Attitudes. This demonstrates that establishing a moderate Brand Image requires balanced, foundational performance across all five brand facets.

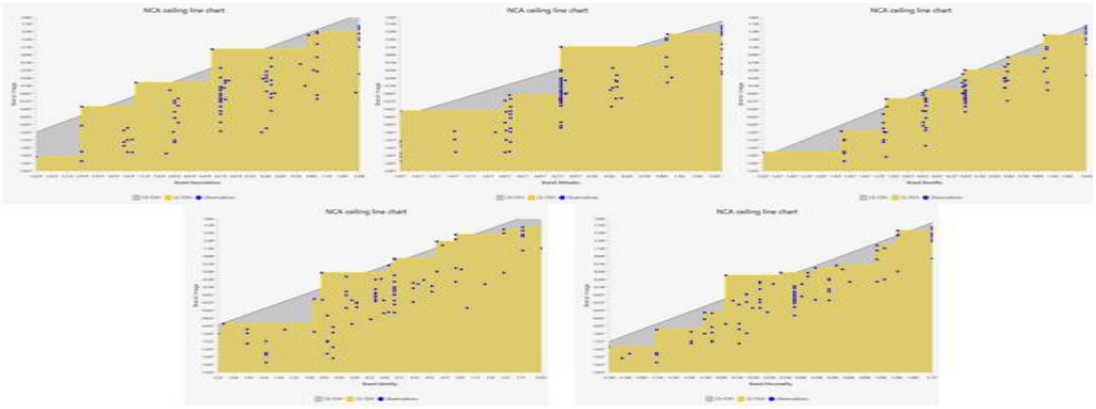


Figure 6. NCA Chart Brand Associations, Brand Attitudes, Brand Benefits, Brand Identity, and Brand Personality

At upper target levels of Brand Image, the bottleneck constraints intensify sharply, revealing steep operational requirements for achieving high brand performance. Reaching a 70% level of overall Brand Image demands significant jump-offs in minimum capacity, requiring 49% Brand Identity alongside high thresholds of 75% for Brand Benefits and 78% for Brand Personality. To attain a top-tier 90% Brand Image outcome, the required bottleneck capacity rises dramatically across the board to 79% for Brand Associations, 84% for Brand Attitudes, 85% for Brand Personality, 86% for Brand Benefits, and 87% for Brand Identity, culminating at the maximum 100% Brand Image level, which demands up to 91% capacity in Brand Identity. Notably, Brand Benefits and Brand Personality present the most severe

operational bottlenecks at upper-middle targets (70%–80%), proving that institutions must deliver clear tangible benefits and a distinct personality to unlock elite brand strength.

Table 10. Bottleneck table – CE and CR-FDH percentage Student Choice

	CE-FDH percentage		**CR-FDH percentage**	
Student Choice	**Brand**	**Trust**	**Brand**	**Trust**
0%	NN	NN	NN	NN
10%	NN	NN	NN	NN
20%	6.5	7.3	NN	0.7
30%	6.9	7.3	3.2	4.9
40%	6.9	7.3	11.4	9.2
50%	11.3	16.6	19.6	13.4
60%	15.9	23.8	27.8	17.7
70%	45.7	23.8	36.0	21.9
80%	49.1	34.4	44.2	26.1
90%	49.1	34.4	52.4	30.4
100%	49.1	34.4	60.6	34.6

The comparative NCA bottleneck analysis table 10 between the step-wise non-parametric technique (CE-FDH) and the linear regression technique (CR-FDH) outlines the precise minimum percentage conditions of Brand and Trust required to achieve specific levels of Student Choice. At lower performance targets (0% to 10%), neither method indicates any necessary conditions (Not Necessary / NN). Starting at the 20% to 30% Student Choice thresholds, bottleneck requirements begin to emerge: the CE-FDH line specifies baseline minimums of 6.5% to 6.9% for Brand and 7.3% for Trust, whereas the smoother CR-FDH line indicates lower initial requirements, rising from 3.2% Brand and 4.9% Trust at the 30% decision level. At a median Student Choice target (50%), CE-FDH demands 11.3% Brand and 16.6% Trust, while CR-FDH projects slightly higher necessity thresholds of 19.6% Brand and 13.4% Trust, demonstrating that basic student choices require a stable foundation in both brand and trust.

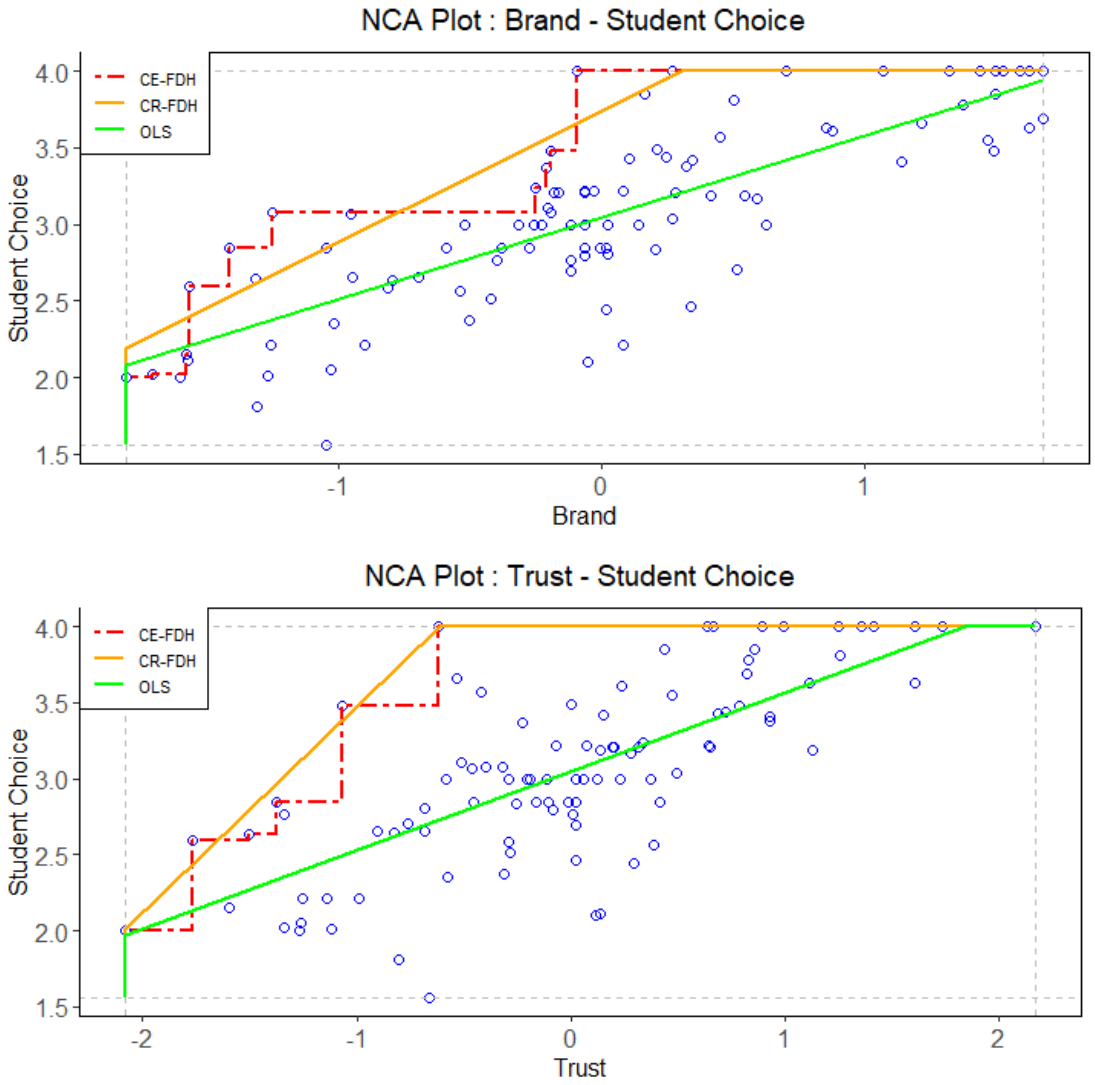


Figure 7. NCA Plot percentage Student Choice

At higher target levels of Student Choice, the two estimation techniques highlight contrasting operational constraint patterns. Under the non-parametric CE-FDH technique, necessary minimums increase steadily before plateauing from the 80% to 100% decision tiers at 49.1% for Brand and 34.4% for Trust. In contrast, the continuous CR-FDH regression line shows a steady, monotonic increase across upper targets, culminating at the maximum 100% Student Choice level with a requirement of 60.6% for Brand and 34.6% for Trust. Figure 11 Across both estimation methods, Brand consistently imposes a substantially higher bottleneck constraint than Trust at upper-tier performance targets (70%–100%), confirming that while baseline trust is indispensable, higher levels of student choice depend primarily on securing strong brand performance.

On Structural Path Analysis, to maximize student enrollment choices, institutional leaders must leverage Brand as the primary direct driver and core mediating bridge within the strategic model. The path analysis demonstrates that Brand exerts a stronger direct influence on Student Choice ($\beta = 0.411$, $p = 0.000$) compared to Trust ($\beta = 0.169$, $p = 0.013$), while also significantly mediating the relationship between Trust and Student Choice ($\beta = 0.325$, $p = 0.000$). Therefore, university management should immediately allocate resources toward strengthening brand communication, enhancing institutional reputation, and highlighting key differentiators. By translating institutional trustworthiness into a clear and compelling brand narrative, the university can convert prospective students' positive perceptions into actual enrollment decisions.

Concurrently, administrators must maintain Trust as an indispensable foundation for building long-term brand equity and driving indirect choices. Because Trust exerts a dominant direct impact on Brand ($\beta = 0.790$, $p = 0.000$, $f2 = 2.865$) and accounts for 57.2% of its variance ($R2 = 0.572$), eroding stakeholder trust will directly cripple the institution's brand standing. Strategic plans must prioritize institutional transparency, ethical communication, and consistent delivery of academic quality. Protecting and enhancing institutional trust ensures a robust pipeline of brand value, ultimately sustaining the model's total predictive power ($R2 = 0.673$) over student choice.

On Importance-Performance Map Analysis (IPMA), institutional decision-makers should prioritize performance improvements in Trust—specifically targeting its Integrity and Benevolence dimensions—to achieve the highest return on investment. The construct-level IPMA reveals that Trust carries the highest total importance (0.713) for Student Choice, yet lags in performance (50.500) relative to Brand (57.891). At the dimensional level, Benevolence displays the highest importance score overall (0.369), while Integrity records the lowest performance rating (46.815). Consequently, management should immediately launch targeted initiatives that demonstrate genuine care for student welfare and reinforce organizational integrity, as improving these high-importance, low-performance areas offers the greatest potential for boosting enrollment choice.

Simultaneously, leadership must maintain and refine key Brand dimensions to safeguard current competitive advantages. While Brand exhibits higher baseline performance (57.891), its sub-dimensions—such as Brand Attitudes (importance = 0.150) and Brand

Benefits (importance = 0.145)—represent crucial operational touchpoints. Administrators should continuously enhance career outcome messaging, academic value propositions, and student support services to elevate brand attitudes. Balancing aggressive performance improvements in low-scoring Trust dimensions with the sustained excellence of core Brand attributes creates a highly optimized institutional strategy.

On Necessary Condition Analysis (NCA), to avoid operational bottlenecks that completely block student enrollment, university leaders must establish non-negotiable minimum thresholds for Brand Benefits and Benevolence. The NCA results identify Brand Benefits as a "perfect necessity" ($d = 0.526$, $p = 0.000$) and Benevolence as the highest trust-based necessary condition ($d = 0.428$, $p = 0.000$). The bottleneck analysis further reveals that achieving a 70% level in Brand Image requires a massive 75% minimum capacity in Brand Benefits, while achieving a 70% level in Trust requires a 72% minimum capacity in Benevolence. Leadership must ensure that marketing and operational teams guarantee baseline career benefits and student care services, as deficiencies in these dimensions will prevent prospective students from selecting the university regardless of other favorable factors.

Finally, management must adjust its operational strategy based on target performance goals using the bottleneck benchmarks. To achieve median student enrollment decisions (50%), the institution must secure at least 24% Brand capacity and 12% Trust capacity; however, aiming for top-tier enrollment outcomes (90%–100%) sharply shifts the primary bottleneck to Trust (requiring 73% capacity) and Integrity (requiring up to 97% capacity). Strategic planners should adopt a phased roadmap: first, secure baseline brand benefits and identity to satisfy lower-to-mid level enrollment goals, and second, systematically elevate institutional trust, integrity, and capability to unlock elite, upper-percentile student choice outcomes.

Identifying a substantial HTMT ratio (0.892) between brand perception and student choice reveals a distinct socio-cultural consumer pattern among private university attendees in Bandung. Specifically, for Generation Z learners at STMIK Mardira Indonesia, an institution's visual identity, prestige, and overall brand attitude function beyond mere external influences; these factors integrate directly into the final decision-making process. This direct alignment demonstrates that within a fiercely competitive private higher education sector,

prospective students psychologically equate a favorable campus image with their ultimate enrollment commitment. Given the close cognitive overlap between these two constructs, university marketers must avoid relying on generic promotional strategies. Instead, administrators must leverage strong foundational trust—specifically institutional benevolence (d = 0.428)—to bridge this conceptual gap, ensuring that positive brand perceptions actively translate into sustained enrollment figures.

The empirical findings present a cohesive, multi-layered view of how Brand Image and Trust interact to drive Student Choice at STMIK Mardira Indonesia. Structural path analysis confirms that Trust exerts a powerful positive influence on Brand Image, while Brand Image acts as the primary direct predictor of Student Choice, complementing broader higher education literature on brand-driven enrollment decisions (Snadrou & Haoucha, 2024). Extending these linear pathways, the IPMA matrix reveals a clear operational hierarchy: Brand Image exhibits the highest total importance in driving Student Choice, making it the primary leverage point for performance enhancement. However, the NCA bottleneck analysis demonstrates that Trust functions as a strict necessary condition—a non-negotiable prerequisite that must reach minimum threshold levels before Brand Image can effectively convert prospective candidate interest into actual enrollment. This structural alignment supports relationship marketing theory, which posits that while brand equity generates immediate behavioral choice, baseline institutional trust must exist to prevent candidate attrition during the evaluation phase (Jain et al., 2024; Hart & Rodgers, 2023).

Beyond direct effects, mediation and bottleneck thresholds illuminate the operational bridge between stakeholder trust and enrollment outcomes. Path analysis confirms that Brand Image significantly mediates the indirect effect between Trust and Student Choice through a complementary mechanism. NCA bottleneck tables quantify this dynamic: to achieve upper-tier target levels of Student Choice (e.g., top 70–80% enrollment yield), STMIK Mardira Indonesia must first satisfy specific, non-zero bottleneck thresholds for both Trust and Brand Image. IPMA performance ratings further show that while baseline Trust currently maintains stable performance, targeted performance gains in key Brand Image dimensions—such as institutional reputation, digital presence, and perceived academic benefits—yield the highest marginal return in student recruitment (Nuseir & El Refae, 2022; Wut et al., 2022). Empirical studies reinforce this dual requirement, showing that organizational trust creates candidate

receptivity, but well-communicated brand attributes convert that receptivity into final choice behavior (Schlesinger et al., 2023; Amani, 2022).

Finally, synthesizing structural effect sizes, IPMA priorities, and NCA thresholds establishes a clear strategic mandate for university leadership. Structural path model parameters confirm that Brand Image holds a dominant direct effect on Student Choice, while Trust exerts a large direct impact on Brand Image alongside a moderate direct effect on choice. IPMA prioritizes resource allocation toward high-importance, moderate-performance Brand Image indicators to maximize competitive advantage. Concurrently, NCA bottleneck analysis enforces a risk-mitigation boundary, proving that neglecting Trust creates a "bottleneck ceiling" beyond which no amount of brand marketing can increase student enrollment choices (Tran et al., 2023). Consequently, STMIK Mardira Indonesia must adopt a synchronized two-pilar strategy: maintaining Trust as a critical, foundational bottleneck requirement while aggressively investing in Brand Image optimization to drive prospective student choice.

CONCLUSION

This study demonstrates that Brand and Trust significantly drive prospective students' private university choices in Bandung, operating through both direct pathways and necessary condition thresholds. The PLS-SEM findings confirm that Brand serves as the dominant direct driver and core mediator of student choice, while Trust acts as the foundational catalyst that generates brand equity. Furthermore, the Importance-Performance Map Analysis (IPMA) highlights Trust—specifically Benevolence and Integrity—as the highest-leverage area for strategic improvement due to its high overall importance and relatively lower performance. Simultaneously, Necessary Condition Analysis (NCA) reveals that institutions cannot achieve high enrollment tiers without securing critical minimum capacities in Brand Benefits and Integrity, proving that both sufficient direct drivers and indispensable prerequisite conditions dictate higher education enrollment success.

Despite these meaningful insights, several methodological limitations boundary the scope of this study. First, the sample size of 100 students focused specifically on private university choices within the Bandung region, which may constrain the generalizability of the findings to public universities or different geographical markets. Second, the cross-

sectional survey design captures student perceptions at a single point in time, limiting the ability to track how prospective students' evaluations evolve across different stages of the enrollment funnel. Third, relying primarily on quantitative closed-ended Likert scales prevents the exploration of deeper qualitative nuances, such as parental influence, financial constraints, or peer dynamics that often shape higher education decision-making.

To overcome these operational and empirical boundaries, university administrators and future researchers must adopt targeted strategies. Institutional leaders should immediately implement the study's recommendations by strengthening communication surrounding Brand Benefits to satisfy necessary bottleneck thresholds while actively improving institutional Integrity and Benevolence to elevate overall trust. For future research, scholars should expand the empirical framework by increasing sample sizes across multi-regional private and public institutions to enhance external validity. Additionally, future studies should incorporate longitudinal designs to track student choice processes over time and integrate complementary qualitative methods—such as focus group discussions—to capture a broader range of socioeconomic and behavioral factors influencing university choice.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

USE OF ARTIFICIAL INTELLIGENCE (AI)

The authors transparently disclose the use of AI Tool exclusively for the purpose of linguistic editing and grammatical refinement of the original draft. The authors maintain full responsibility for the manuscript's substantive content, data integrity, and final scientific conclusions.

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