Effects of Value Co-Creation on Student Loyalty, Satisfaction, and University Image: A Case Study of an Anonymous Rajabhat University

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Abstract

A university's primary duty is to provide essential skills to help students work well after graduation. The quality of a university's students depends on the university's value proposition. In the past, Rajabhat University's value proposition may not have been sufficiently constructed with co-creation. Although co-creation may now be more emphasized, it is still insufficient. The primary objective of this study is to use a composite model based on the structural equation model of students' experiences to assess the impacts of co-creation, student satisfaction, loyalty, and university image. The data were collected from a population of 500 students enrolled at an anonymous Rajabhat University using a questionnaire. The sample population comprised 125 students, randomly selected from four classes of the four years of education. The model used a reflective-formative type two-stage approach while the algorithm was composite. This study used the third analysis to form a three-level model of co-creation. The second-order results showed that coproduction was positively related to university image and student satisfaction. Value-in-use was positively associated with university image, student satisfaction, and loyalty. The third-order constructs showed that value co-creation was positively related to university image, student satisfaction, and loyalty.

Keywords: Co-creation, Satisfaction, Image, Loyalty, Composite model

Introduction

A university's essential obligation is to prepare students to work efficiently after graduation, increasing the university's reputation. However, if there is a difference in the value proposition, the question of university efficiency will be raised until the university understands the concept of value co-creation. A university's value creation cannot be recognized as distinct from the students' point of view. Therefore, the value of co-creation should be conveyed to the university. Following this, the university should examine what the best unique value

proposition is for it. The ideal concept is that students and universities should co-create university value.

Student enrolment has dropped at most of Thailand's universities due to external and internal causes such as a decreasing birth rate. In the 1980s, approximately one million babies were born each year. Since then, the number has progressively decreased, and is expected to reach 600,000 by 2020. Thailand's birth rate is expected to decrease below 500,000 over the next decade, (The Nation, 2022), inspiring Rajabhat Universities to create innovative marketing techniques. Given the co-creation idea, Rajabhat University has started using commercial themes to compete for students. At the moment, implementation and knowledge on co-creation may not be occurring effectively at Rajabhat University. Additionally, university and student expectations differ, demanding collaboration among participants to improve the quality of education for both students and universities. Universities and students alike must work to improve their institutions' reputations. While a university can benefit from the number of students and the budget cap, a student is expected to succeed in the workforce soon after graduating.

Throughout the co-creation process, a university and its students will cocreate to improve student comprehension and experience. A university can move its assets to the training development, practice, and innovation production chain (Prahalad & Ramaswamy, 2004). The student resources are intelligence, behavior, methodology, responsibility, and individual needs, including study experiences (Díaz-Méndez & Gummesson, 2012). The conceptual framework for co-creation at a university could be indistinct (Ranjan & Read, 2016). The essential co-creation idea comprises two measurements: coproduction and value-in-use; However, numerous researchers utilizing any one factor speak of value co-creation (Dollinger et al., 2018). In this way, the aftereffects of several past studies cannot show the beneficial result of significant co-creating value (Ranjan & Read, 2016).

The present study used the co-creational concept of Ranjan and Read (2016); Dollinger et al. (2018) to examine value co-creation at Rajabhat University and to study the impact of value co-creation on satisfaction (Elsharnouby, 2015), university image (Lafuente-Ruiz-de-Sabado et al., 2019), and loyalty (Annamdevula & Bellamkonda, 2016). The present study constructed a hierarchical component model of co-creation, satisfaction, and university image based on a composite algorithm and Mode B (i.e., the outer weights are multiple regression coefficients with measurements as independent variables and latent variables as dependent variables). The student loyalty model used the mode A (i.e., the outer weights are the construct-indicator correlations) consistent algorithm or the consistent partial least square (PLSc) as a factor variable with the reflective model. Generally, analysis of the effects of student loyalty on value co-creation is rare. The value co-creation model needs to be built into the third-order construct. In contrast, satisfaction and image are the second-order constructs based on their three- and two-stage aspect designs. In co-creation, the first stage is knowledge sharing, equity, interaction, experience, personalization, and relationships; the second is coproduction and value-in-use, and the third is co-creation. They use co-creation, university image, and student satisfaction as latent variables. At the same time, this study treats it as a composite that will fill

the existing literature gap. The conclusions of this study may assist Rajabhat University in strengthening its co-creation methods to achieve greater collaboration with all stakeholders.

Literature review

After graduation, a loyal student can bring various benefits to a university. A university's alumni assist (a) financially; (b) through word-of-mouth promotion to prospective, current or former students; and (c) through some forms of cooperation (Henning-Thurau et al., 2001). Consequently, numerous researchers have developed the loyal student model to examine different antecedents. Student satisfaction (Alves & Raposo, 2007), university image, university reputation (Nguyen & LeBlanc, 2001), quality of university services (Lin & Tsai, 2008), and trust are the most widely used antecedents. The present paper utilized coproduction and value-in-use as indicators of co-creation value to examine the impact on university image, student satisfaction, and loyalty to Rajabhat University in Thailand (see Figure1). The co-creation value is positively related to university image, student satisfaction (Nguyen, Lin, & Lam, 2021) and student loyalty (Annamdevula & Bellamkonda, 2016). The following are the significant variables used in this study:

Value co-creation

The growth of information technology has turned selling theory into logic-dominant products with the highest efficiency, but this has been insufficient because there is still interest in the product. Consequently, the concept has become a service-dominant logic (Vargo & Lusch, 2008). In service-dominant (S-D) logic, the proposal for economic exchange is to provide reciprocal service, which means that both consumers and producers are co-creators of value (Vargo et al., 2010). The product is the value proposition, and the client is a co-creator by presenting, bargaining, reacting, pledging, and engaging with the service. Students are involved in the university context (Kuh, 2003) but not based on a co-creative framework (Bovill & Felten, 2016). A university and its students should share information and knowledge; that is, the university should find a way to encourage its students to bring their resources to the university. This will add value to attract new students to the university and create value co-creation consisting of two main components: coproduction and value-in-use (Ranjan & Read, 2016), which were analyzed in this study.

Co-production (CO1)

Coproduction means students can bring their resources to engage in the university's production process, which can come from the initial development of educational programs (Grönroos, 2011). The product or service of coproduction is the value proposition (Lusch & Vargo, 2006). Abeysekera and Dawson (2015) suggested three considerations that provide insight into the task/role, ability or capacity, and motivation (Lengnick-Hall et al., 2000) to explore the advantage of coproduction. The clearness of students' task, skills, and motivation relates to the students' experience, knowledge, and expertise in the university's service production process. Coproduction is the constructed variable in which knowledge, equity, and engagement are indicators (Ranjan & Read, 2016). Therefore, coproduction can be positively

associated with the image, satisfaction (Pacheco et al., 2013), and loyalty of universities (Auh et al., 2007). Technology and society change rapidly, so a university cannot react quickly. Thus, universities worldwide can cocreate students with collaboration from outside organizations such as businesses, customers, and government. The National Science and Technology and Development Agency and King Mongkut's University of Technology North Bangkok coproduce a master's degree and a doctoral degree in science and technology. Valaya Alongkorn Rajabhat University partners with the Central Group to coproduce a new retail business management bachelor's degree for which the Central Group pays and students' tuition fees. The following were the determinants of co-production in this study: knowledge sharing, equity, and interaction.

Knowledge Sharing (CO1_1)

Knowledge sharing, which manages the university's resource-related value proposition, applies to colleges where students use their knowledge and skills to co-create innovation (Ramirez, 1999). Sharing knowledge will encourage a university to understand current and potential student needs, which can be the best way to build programs and create value for a university and its students. A university is a traditional, inflexible institution, though education is the biggest competition. Therefore, a university will boost its adaptability through co-creation, and students can co-create innovation with the university. Students will share their knowledge of building educational innovation and reducing potential damage. Co-creation will inspire students to learn business and industry culture, leading to postgraduate jobs (Oosterlinck, 2004). Therefore, knowledge sharing will determine coproduction.

Equity (CO1_2)

Equity applies to almost all students giving their knowledge and resources to the university (Gummesson, 2002). All students, not just one party or student leader, should share university resources and, preferably, be active in co-creation (Prahalad & Ramaswamy, 2004). The mechanism must be open to trusting students, leading to real co-creation (Leavy, 2012), which will be university-student equity (Vargo et al., 2008). An organization's ability to provide fair access to customers can depend on two factors (Dollinger et al., 2018) that are deeply rooted in the organization's narcissism and inability to give up control (Prahalad & Ramaswamy, 2004) and provide a positive experience for its customers (Payne et al., 2008). Balanced relations and equal access are essential factors in the co-creation/coproduction process (Dollinger et al., 2018; Fisher & Smith, 2011).

Interaction (CO1_3)

University-student interaction is an essential coproduction function. Vargo and Lusch (2008) found the interaction between an organization and its consumers to be a relationship between relatives. This interaction will boost the old-fashioned seller–buyer relationship in which (a) the organization can respond to any value chain mechanism (Prahalad & Ramaswamy, 2004) and (b) the consumers can share their knowledge at any point. The organization and customers will co-create unique experiences that use high-quality interactions to achieve economic value, which can be anywhere in the system (Prahalad & Ramaswamy,

2004). Interaction is the way to create value for both customers and organizations; thus, it may strongly determine coproduction.

Value-in-use (CO2)

The value-in-use is the value of a customer-determined product that relies on its reasons for using the product or service. Thus, the value assumed by a university may not be realized because the students' context is different from the assumed service design phase. A university should provide products and services of high value to students according to their backgrounds and transform the customer context to apply the appropriate competency to realize the value. Therefore, value-in-use benefits both students and the university, which may positively relate to the university's image, student satisfaction, and loyalty. The study's determinants of value-in-use were experience, personalization, and relationship.

Experience (CO2_1)

Experience refers to study experience and participation in university activity. It is the key mechanism that influences students' impression of their history studying at a university. They are happy and committed to a university if they have positive experiences. Then, students will reconstruct their favorable experiences with the organization (Füller et al., 2011). Co-creation has a positive relationship with consumer satisfaction that depends on service experiences (Vázquez-casielles, Iglesias & Varela-neira, 2017). The students' positive experiences at a university will determine the value-in-use.

Personalization (CO2_2)

Personalization refers to a student's individual needs, which may be within any production process from the starting stage (Ramaswamy & Ozcan, 2014). Each student has different needs and study experiences. For example, a university can allow students to arrange their course registration each semester depending on their needs and requirements. Regularly, university co-creation customizes products or services for students, leading to student satisfaction and loyalty. Zine et al. (2014) stated that a customer's participation in the co-creation process, it would evoke customized service for their requirements. A student can personalize the services offered, and a university will co-create value through codesign and coproduction, leading to increased productivity. Thus, personalization may have positive results related to value-in-use.

Relationship (CO2_3)

Student-university relationships assess a university's attitudes and perceptions of students (Carini et al., 2006). A positive relationship is the strength of future co-creation. Value co-creation from positive relationships, continuing negotiation, and equal status (Prahalad & Ramaswamy, 2004) would improve student-university relations. Co-creation of consumer value has a statistically significant effect on the consistency of relationships, satisfaction, and trust (Omar et al., 2018). Many scholars (e.g., Chen & Myagmarsuren, 2011) have shown that a high level of relationship quality increases loyalty (Omar et al., 2018). Thus, it can determine value-in-use significantly.

Satisfaction

Parahoo et al. (2013) proposed four factors to determine university satisfaction. These factors include the university's reputation, the faculty's perceived academic competence, the interaction of student and administrative I.T. staff, and student_student interactions. Many scholars (e.g., Dollinger et al., 2018) have found a relationship between co-creation and satisfaction. The current study uses Elsharnouby's (2015) questionnaire, which uses a covariance-based structural equation model (CB-SEM) suitable for reflective measurement. Nonetheless, this study found that four variables determine satisfaction; thus, the model should be constructed formatively. Many scholars (e.g., Aguirre-Urreta et al., 2016) avoid using causal formatives if the R-squared is less than 1. The following can create student satisfaction artifacts by their determinants (Henseler, 2017). Thus, the composite model should be constructed. The university's reputation, faculty academic competence, staff service quality, and student_student interactions were all identified as determinants of student satisfaction in this study.

The reputation of the university (SAT1)

Before studying at a university, a student assesses or recognizes the university's reputation as an outsider, and then the student experiences university activity and innovation directly. University competency impacts students' satisfaction with a university (Hartman & Schmidt, 1995). Alwi and Kitchen (2014) found that a university's reputation and image impact its students' satisfaction. Several researchers (e.g., Nguyen & LeBlanc, 2001) found that university reputation is the crucial position students use to assess their satisfaction with selected universities.

Perceived faculty academic competence (SAT2)

Teaching competency is essential for the university values that directly improve student competence and positively predict satisfaction (Voss et al., 2007). The skill and atmosphere of the faculty play a crucial role in perceiving university quality, which affects satisfaction, trust, and commitment to a university (Elsharnouby & Parsons, 2010).

Service quality of staff (SAT3)

University service relies on the quality of its personnel and information technology, directly impacting the university's student satisfaction. Parahoo et al. (2013) suggested that student satisfaction with university technology, recreation, and education would affect university satisfaction. Emotion (White, 2010), service quality (Krot & Lewicka, 2011), and staff communication effectiveness (Jorfi & Jorfi, 2011) may positively affect student satisfaction.

Student–student interactions (SAT4)

The educational environment of each university is distinct and depends on numerous factors, including student_student interaction (Elliott & Shin, 2002). Student_student interaction refers to more than the classroom and relates to student and social university interaction. The educational environment is positively associated with student satisfaction at the university.

University image

University image refers to perceived university-related publications (Aghaz et al., 2015). University image focuses on responsiveness to students and stakeholders (Keller, 2008). Duarte et al. (2010) determined that university image has four factors. They are elements of communication, social life, courses, and job opportunities. Lafuente-Ruiz-de-Sabando et al. (2019) constructed a university image with a second-order construct using formative measurement. The determinants included the perception of the academic offerings, the perception of graduate training, the perception of costs, the perception of massification, the perception of teaching resources, and a compelling image. Lafuente-Ruiz-de-Sabando et al.'s (2019) image dimensions may be appropriate to the Rajabhat University context. However, I develop new indicators for measuring the perception of graduate training, perception of costs, and perception of massification. Perception of academic offerings, perception of graduate training, perception of costs, perception of massification, perception of teaching resources, compelling image, and perception of research resources were the predictors of university image in this study.

Perception of the academic offerings (IM1)

The training program of a university plays a crucial role in university quality, which is a significant factor in the university's image from a societal perspective (Kazoleas et al., 2001). Therefore, the image of courses (Kazoleas et al., 2001), range of courses (Gray et al., 2003; Ivy, 2001; Palacio et al., 2002), and image of university degrees (Duarte et al., 2010) are positively related to university image.

Perception of graduate training (IM2)

Almost all materials and several programs in a university provide orientation and training to students to improve their competence. Thus, all factors that support students, including the quality of the study plans and learning content, are positively related to university image (Maric et al., 2010). Lafuente-Ruiz-de-Sabando et al. (2019) found that graduate training possitvely affects university image. Improving an internship program is expected to enrich student experiences, knowledge, and skills in professional life, thereby increasing job opportunities (Jaradat, 2017). The quality of teaching (Suarman, 2015) and a good internship program represent the quality of graduate training. A graduate student who works efficiently in the labor market results in a positive university image.

Perception of costs (IM3)

Rajabhat University is a state-owned institution from which students and the government receive funds. Thus, all university expenses (Gray et al., 2003; Palacio et al., 2002) affect the university's image. If society's perception is positive, then the image is good; otherwise, the image is terrible (Lafuente-Ruiz-de-Sabando et al., 2019). At Rajabhat University, the three main student costs are tuition fees, accommodations, and food.

Perception of massification (IM4)

Lafuente-Ruiz-de-Sabando et al. (2019) measure massification with the number of students per classroom and an appropriate number of administrative and service staff. A significant aspect of massification is that of large-scale teaching (Hornsby & Osman, 2014). This is directly related to university performance, which positively relates to student and

faculty numbers if all factors, including costs and innovation, meet student and faculty efficiency requirements. The lower the student-to-faculty ratio is, the higher the quality. Thus, as perceived by society, massification is positively related to university image (Luque-Martínez & Del Barrio-García, 2009).

Perception of teaching resources (IM5)

Teaching tools are the sense of enhancing student and university education through university equipment and services, teaching staff efficiency, and available facilities. Different scholars (e.g., Gray et al., 2003; Palacio et al., 2002) have found that teaching resources positively affect university image. Teacher quality may be a critical predictor of university reputation (Maric et al., 2010).

Affective image (IM6)

All of the above components reviewed are cognitive aspects essential for university image. Moreover, many scholars (e.g., Alessandri et al., 2006; Sontaite & Bakanauskas, 2011) have found affective components to affect university image significantly**.**

Perception of research resources (IM7)

Research is the faculty's main activity to increase the stock of knowledge by dedicating part of their time to research work (Lafuente-Ruiz-de-Sabando et al., 2019). Academic research creates significant long-term effects for staff (Mitra & Golder, 2008) and universities. Research can thus create an image of a well-known university (Mitra & Golder, 2008). Research resources relate positively to university image (Ivy, 2001; Kazoleas et al., 2001)

Loyalty

Loyalty is an affiliation with goods or services that directly influences customer behavior (Jones & Sasser, 1995). Loyalty is the product or service attitude directly affecting students' measurable achievement (Nyadzayo & Khajehzadeh, 2016). For example, loyalty affects retention, is closely linked to the desire to study at an old university (Mohamad & Awang, 2009), and helps increase student enrollment (Taecharungroj, 2014). Loyal alumni will support their university in several ways, such as donations, placement of internships, co-development of new courses, and recruitment of new students.

The central assumption & conceptual framework

Grissemann and Stockburger-Sauer (2012) suggested that co-creation will lead to greater satisfaction and loyalty. Dvorak and Brooks (2013) found consumer satisfaction in co-creation activities. Co-creation value can fulfill customer needs while supporting companies (Edvardsson et al., 2011). Lee, et al. (2018) found co-creation to be a determinant of loyalty in fitness clubs, and Cambra-Fierro et al. (2017) found that co-creation explicitly impacts customer satisfaction, customer loyalty, and WOM. Iglesias et al. (2018) observed that co-creation determines customer trust and loyalty. Many scholars (e.g., Auh et al., 2007; Ramaswamy & Gouillart, 2010) have found a high effect of co-creation on satisfaction. Bowden and D'Alessandro (2011) suggested that co-creation makes a university understand the needs of students. Kandampully and Suhartanto (2000) considered loyalty-determined

image and satisfaction. A university will provide valuable learning opportunities to improve student satisfaction. Co-creation thus strengthens the university profile. This study, examined co-creation, university image, and student satisfaction using a composite model, with student loyalty as the latent variable. Additionally, co-creation and student satisfaction were measured using second-order constructs, while university image was measured using third-order constructs, all of which were of the formative-formative type. This strategy had the potential to be more effective in demonstrating the impact of co-creation on student satisfaction, university image, and student loyalty. The construction of the hypotheses is shown in Figures 1 and 2.

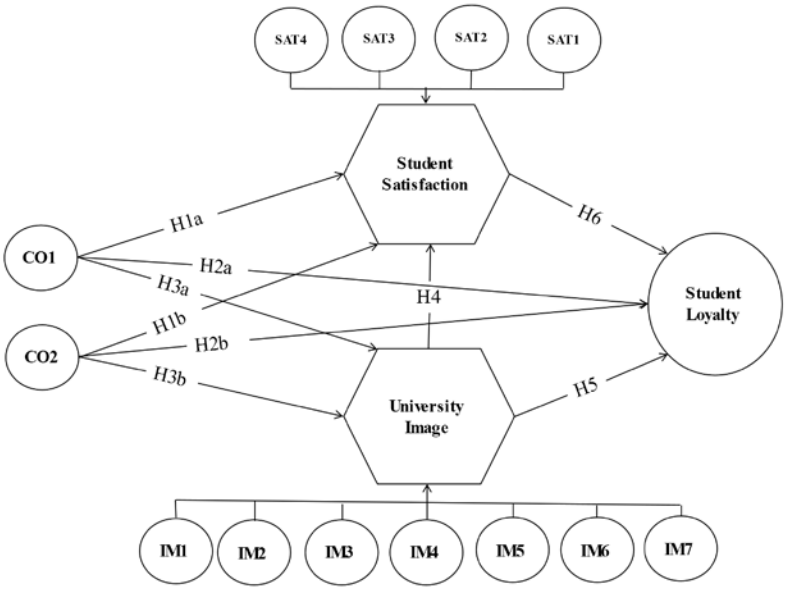

Figure 1 Conceptual second-order framework

H1a: Coproduction is positively related to student satisfaction.
H2a: Coproduction is positively related to student loyalty.
H3a: Coproduction is positively related to university image.
H1b: Value-in-use is positively related to student satisfaction.
H2b: Value-in-use is positively related to student loyalty.
H3b: Value-in-use is positively related to university image.

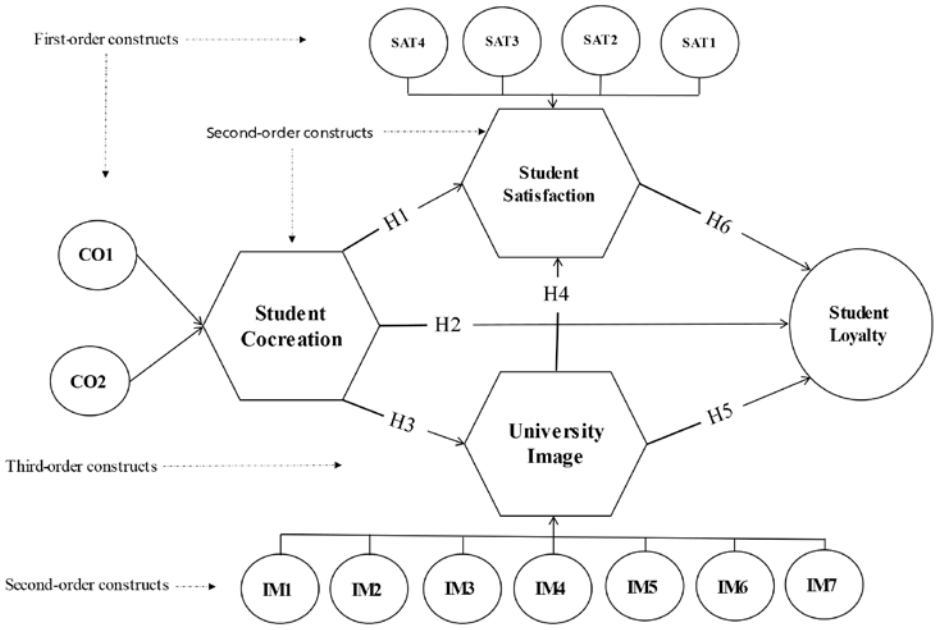

Figure 2 Conceptual third-order framework

The perceived university image refers to human perceptions of and experiences with the university, informed by elements of the university. Variables IM1-IM7 help describe university image (Aghaza et al., 2015; Duarte et al., 2010). Many scholars (e.g., Alves & Raposo, 2010; Weerasinghe & Fernando, 2018) considered the image a determining factor in customer satisfaction. The image indicates that student satisfaction in higher education influences student loyalty (Alves & Raposo, 2007). A hypothesis is set as follows.

H1: Co-creation is positively related to student satisfaction.

H2: Co-creation is positively related to student loyalty.

H3: Co-creation is positively related to university image.

H4: University image is positively related to student satisfaction.

H5: University image is positively related to student loyalty.

In the higher education context, several empirical studies report that student satisfaction positively influences student loyalty (Alves & Raposo, 2007; Brown & Mazzarol, 2009). Thus, I construct H6 as follows:

H6: Student satisfaction is positively related to student loyalty

Research method

The sample and population

This case study of 10,380 Anonymous Rajabhat University students in October 2019. The sample size was determined according to Soper (2019), which varies based on effect size (0.15), power (0.80), latent variable (22), indicators (59), and probability level (0.05). Using these parameters in the Soper (2019) process, the minimum sample size would be approximately 253. This analysis used 500 samples, which meets the minimum sample size.

Stratified sampling was used to divide the 500 samples into four classes, depending on the year of study. There are approximately 125 students for each year of education, and the students were randomly sampled.

Questionnaire development

The present study questionnaire is based on the co-creation concept of Ranjan and Read (2016) and Dollinger et al. (2018). The idea of satisfaction is based on Elsharnouby (2015), the idea of the image is based on Lafuente-Ruiz-de-Sabando et al. (2019), and the idea of loyalty is based on Annamdevula and Bellamkonda (2016). However, the researcher adapted some indicators appropriate for Rajabhat University content, which consisted of 38 institutes throughout Thailand, each of which depended on its own governance body. However, they are under the same act in which the main objective is service to the local community. Value co-creation was primarily inspired by Ranjan and Read (2016) and Dollinger et al. (2018). The researcher developed SAT3, which plays a significant role in human-based service more than information technology-based service, for an anonymous Rajabhat University. The emotion and communication method of staff may relate to student satisfaction. The questionnaire consisted of two sections. The first part covered demographic information with four items. The second component comprised co-creation, satisfaction, loyalty, and university image, consisting of 63 indicators on a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree." The initial questionnaire was in English and translated into Thai. The two translators translated the instrument separately from English to Thai, both translators were native Thai but fluent in English. Then, two back-translators were fluent in both English and Thai. Eventually, the researcher evaluated whether the questionnaire contained the same ideas in English and Thai, and whether the content was correct. The reliability of the translated instrument was tested before data collection. The 40 questionnaires will be tested with 10 students per year of education. The average Cronbach's alpha is 0.87, above the 0.70 thresholds.

Estimating

Co-creation, university image, and student satisfaction are composite models using the composite algorithm and mode B. Student loyalty using a reflective model and algorithm have consistent partial least square values. Co-creation is a three-stage construct, whereas university image and student satisfaction are second-order constructs. A second-order construct is a disjoint two-stage approach (Becker et al., 2012) that utilizes standard first-order construct scores to create the second-order construct variables through a reflective-formative and two-stage approach. These constructs used a composite algorithm and mode B for co-creation, student satisfaction, and university image, whose three constructs compose the artifact variable (Henseler, 2017). Regarding the third-order constructs, the standard constructs of coproduction and value-in-use scores are the co-creation model indicators. All estimations use bootstrapping 4,999 rounds with ADANCO (Henseler & Disjkatra, 2015).

Partial Least Squares Structural Equation Model (PLS-SEM)

The PLS-SEM is more efficient for conducting structural equation models, especially in light of Ronkko and Everman's (2013) criticism. This led to the development of the significance of adaptive PLS-SEM. By utilizing a consistent partial least squares (PLSc) model, Dijkstra and Henseler (2015ab) have shown that it is closely related to a latent variable. Henseler et al. (2014) developed a formative model to address the concerns of interpretation confounding associated with using causal-formative models. They did so by utilizing emergent variables in a composite model. The emergent variable can generate indicators that are emergent, latent, or observable (Jhantasana, 2022; Hubona et al., 2021; Yu et al., 2021). Thus, if all constructs in the model are latent, or PLSc variables, then a confirmatory factor analysis is performed. However, confirmatory composite analysis is performed if all constructs are emergent variables (Henseler, 2017). This modern PLS-SEM model may prove to be an efficient way to measure the model in this investigation.

The PLS-SEM consisted of measurement and structural models. The measurement model shows the relationship between the construct and its thought-loading (weight) indicators. The structural model shows the relationship between the constructed model and the thought path coefficient. The measurement model can take three forms: reflective, causal-formative, and composite. The reflective model is suitable for factor data in which each indicator is the dependent variable. The construct is an independent variable as a simple regression, which includes each indicator with an error term. In the causal formative model, the constructed variable is the dependent variable, whereas all indicators are independent variables as multiple regressions. The error term is included in the constructed variable. However, many scholars found that bias in the causal-formative model should not be used. Therefore, this study uses a composite model that can be formatively measured without a residual as an indicator that defines the artifact-assuming construct in which the relationship depends on interpretation, such as consumer mix and brand equity (Henseler, 2017).

Model fit criteria

The saturation and estimation determine the goodness of fit of ADANCO's model (Henseler, 2017). The bootstrapping model was used to identify the inconsistency between the data and the model-inferred correlation matrix (Dijkstra & Henseler, 2015). There are three statistics to measure model fit-the Standardized Root Mean Square residual (SRMS), the unweighted minimum square discrepancy (d_{ULS}), and the geodesic discrepancy (d_G). There are two criteria. First, the 95% (HI95) and 99% (HI99) quantile bootstrapping results should be lower than the requirements. Second, if the first criterion is not met, the SRMR value below 0.08 (Hu & Bentler, 1999) can be considered.

Measurement model criteria

The measurement model criteria were internal consistency reliability, indicator reliability, convergent validity, and discriminant validity. The internal consistency reliability means that the questionnaire will measure the same things, and the result should be the same

or consistent. Its parameters are Dijkstra-Henseler's rho (ρA) and Jöreskog's rho (ρC), which should be greater than 0.70. The reliability of the indicator should exceed 0.708 (Henseler & Disjkatra, 2015), suggesting that the indicator can be used to calculate its structure. Convergent validity and discriminant validity rely on theory to quantify characteristics or behavior. The convergent validity indicates that the indicator in the same framework is remarkably correlated with an average variance extracted (AVE) above 0.50. The discriminant validity measure should be distinct and below 0.85 (Henseler et al., 2015).

Composite model criteria

The composite model criteria for the formative model may be the same (Sarsted et al., 2019, Henseler, 2017), which is very similar to formative measurement criteria but does not include redundancy analysis. The requirements were the nomological net, multicollinearity, loading significance, weight, and loading relevance. The nomological net refers to the theory-based sign and constructs a variable. The multicollinearity test is that the variance inflation factors (VIFs) should not surpass 5 (Hair et al., 2011). The weight must be significant; however, if it is negligible, the loading significance is not less than 0.50, which can keep the indicator within the model.

Structural model criteria

The structural model parameters are assessed using the coefficient size, path, and sign, including the effect size (f^2), relationship size (R^2), and predictability size (Q^2). The path coefficient should be more than 0.20, and the significance and sign should be positive. The effect size if it exceeds typically 0.15 (Cohen, 1992), and the R^2 indicates a medium size if it exceeds 0.33 (1998).

Results

This study appears to be distinct from the general hierarchical component model in which a higher-order construct indicator is derived from the lower-order standard score for reporting results based on Sarsted et al. (2019). In addition, the lower-order construct report of the measurement model in reflective or formative form depends on the model type. The higher-order construct report results from the structural model parameters. This study requires a second-order measurement and structural model to examine the impacts of coproduction and value-in-use on university image, student satisfaction, and student loyalty (Figure 1), whereas the third-order construct (Figure 2) shows the co-creation effect. Thus, the second_and third-order hypotheses are tested, which usually do not appear simultaneously on both levels.

Demographics result

The demographics consisted of three variables based on my assumption that different genders, ages, and years of education may cause differences in co-creation, image, satisfaction, and loyalty. The data consisted of 317 (63.4%) females, and the majority were aged 19-20 years

(247 or 49.4%) and 21-22 years old (204 or 40.8%). The sample population for each year of education was calculated at approximately 25% each year of education.

First-order constructs

Model fit

The first-order model utilizing the repeated indicator method (Ringle et al., 2012) cannot produce the fit indicator model. Nonetheless, this approach is the most commonly used reflecting type, but it cannot achieve discriminant validity due to repetitive indicators.

Measurement model

Table 1 shows that almost all the criteria for measuring the quality of the measurement model are over their standards. Regarding internal consistency reliability, all ρ_A, ρ_C, and alpha values ranged from 0.767 to 0.930. The indicator reliability is loading over 0.708 except for two: my current university is known for its excellent academic programs (SAT11) and study materials such as the library and computers are appropriate (IM51). Regarding convergent validity, the average variance extracted (AVE) of all constructs is over 0.5. Discriminant validity is not achieved due to the use of repeated indicators to measure their construct values.

Table 1 The first-order constructs

	Loading	**Dijkstra-Henseler's rho (ρ_A)**	**Jöreskog's rho (ρ_c)**	**Cronbach's alpha (α)**	**The average variance extracted (AVE)**
Knowledge sharing (CO1_1)		0.830	0.826	0.823	0.613
CO11	0.719				
CO12	0.839				
CO13	0.786				
Equity (CO1_2)		0.854	0.853	0.852	0.659
CO14	0.776				
CO15	0.840				
CO16	0.818				
Interaction (CO1_3)		0.814	0.814	0.814	0.593
CO17	0.765				
CO18	0.759				
CO19	0.786				
Experience (CO2_1)		0.809	0.808	0.809	0.584
CO21	0.786				
CO22	0.727				
CO23	0.778				
Personalization (CO2_2)		0.820	0.820	0.820	0.603
CO24	0.774				
CO25	0.791				
CO26	0.765				
Relationship (CO2_3)					
CO27	0.862	0.854	0.850	0.850	0.655
CO28	0.823				
CO29	0.739				

	Loading	Dijkstra-Henseler's rho (ρ_A)	Jöreskog's rho (ρ_c)	Cronbach's alpha (α)	The average variance extracted (AVE)
University reputation (SAT1)		0.769	0.769	0.768	0.624
SAT11	0.670				
SAT12	0.778				
SAT13	0.802				
Perceived faculty academic competence (SAT2)		0.849	0.849	0.848	0.584
SAT21	0.735				
SAT22	0.762				
SAT23	0.786				
SAT24	0.771				
Perceived service quality of staff (SAT3)		0.831	0.829	0.829	0.618
SAT31	0.815				
SAT32	0.800				
SAT33	0.742				
Student-student interaction (SAT4)		0.831	0.826	0.828	0.614
SAT41	0.850				
SAT42	0.768				
SAT43	0.726				
University image Perception of the academic offerings (IM1)		0.846	0.844	0.842	0.644
IM11	0.751				
IM12	0.823				
IM13	0.831				
Perception of graduate training (IM2)		0.838	0.835	0.833	0.629
IM21	0.771				
IM22	0.852				
IM23	0.754				
Perception of costs (IM3)		0.930	0.924	0.923	0.754
IM31	0.739				
IM32	0.896				
IM33	0.918				
IM34	0.908				
Perception of massification (IM4)		0.873	0.873	0.873	0.696
IM41	0.832				
IM42	0.838				
IM43	0.832				
Perception of teaching resources (IM5)		0.768	0.768	0.767	0.623
IM51	0.601				
IM52	0.801				
IM53	0.777				
Affective image (IM6)		0.889	0.888	0.888	0.664
IM61	0.821				
IM62	0.808				
IM63	0.781				
IM64	0.848				
Perception of research resource (IM7)		0.801	0.801	0.800	0.572

	Loading	Dijkstra-Henseler's rho (ρ_A)	Jöreskog's rho (ρ_c)	Cronbach's alpha (α)	The average variance extracted (AVE)
IM71	0.743				
IM72	0.774				
IM73	0.752				
Loyalty		0.888	0.886	0.887	0.608
LOY1	0.841				
LOY2	0.812				
LOY3	0.755				
LOY4	0.730				
LOY5	0.757				

Second-order constructs

Model fit

In the second-order model, the indicators of coproduction, value-in-use, university image, and student satisfaction come from their standard construct scores from the first-order constructs. The coproduction, value-in-use, university image, and student satisfaction algorithms are composite and mode B algorithms, whereas student loyalty uses reflective constructs and the PLSc algorithm. The SRMR, d_{ULS}, and d_G results are 0.043, 0.466, and 0.204, respectively; whereas the HI99s are 0.030, 0.231, and 0.116, respectively. All results are higher than HI99, but the SRMR is below 0.08.

Measurement model

The first order is reflective using a repeated indicator approach, whereas the second-order constructs use a two-stage approach to the composite model. The second-order composite model criteria include the nomological network, multicollinearity, weight, and relevance (Henseler, 2017). Figure 3 shows the variable-based construction relationship based on the theory that coproduction and value-in-use determine university image, student satisfaction, and loyalty. The image of the university and student satisfaction are antecedents of student loyalty. The sign and size of the relationship are positive and significant, respectively.

Table 2 shows the results of the loadings, weights, the significances of the weights, and multicollinearity. Nearly all indicators contribute significantly to their construct except CO1-1 (knowledge sharing), CO1-3 (interaction), IM2 (perception of graduate training), and IM3 (perception of costs). The t-weight statistic was insignificant at less than 1.96. However, when considering weight relevance, it was found that almost all loadings exceeded 0.5 except that of IM3. Moreover, all constructs have VIFs between 1.452 and 2.558 (should be less than 5). Thus, in the third-order model, IM3 should be removed from the model before analysis.

Table 2 The composite criteria of the second-order model

Indicator	Dijkstra-Henseler's rho (ρ_A)	Loading	Weight	T-Weight	VIF
Loyalty	0.888				
LOYAL1		0.847	0.263	21.419	1.897
LOYAL2		0.811	0.251	25.815	2.701
LOYAL3		0.754	0.234	24.987	2.623
LOYAL4		0.726	0.225	23.437	2.395
LOYAL5		0.754	0.234	20.547	2.558
Co-creation	1				
CO1_1		0.623	0.073	1.187	1.607
CO1_2		0.771	0.264	4.286	2.023
CO1_3		0.740	0.111	1.630	1.920
CO2_1		0.820	0.257	3.937	2.014
CO2_2		0.804	0.260	3.605	1.867
CO2_3		0.785	0.317	4.844	1.654
Satisfaction	1				
SAT1		0.747	0.274	4.576	1.522
SAT2		0.807	0.335	5.326	1.683
SAT3		0.790	0.356	6.439	1.547
SAT4		0.713	0.342	6.867	1.288
Image	1				
IM1		0.780	0.396	5.806	1.772
IM2		0.656	0.074	1.030	2.001
IM3		0.428	-0.076	-1.052	1.453
IM4		0.725	0.251	3.521	1.613
IM5		0.636	0.168	2.697	1.459
IM6		0.688	0.242	3.765	1.452
IM7		0.757	0.290	4.177	1.589

Structural model

Typically, the hierarchical structure model does not need to analyze the lower-order structural model. However, the present study needs to investigate the effect of the relationship between coproduction and value-in-use on university image, student satisfaction, and loyalty. The testing results for hypotheses H1a, H2a, H3a, H1b, H2b, and H3b are shown in Figure 3 and Table 4. Almost all hypotheses, except H2a, acknowledged the association between coproduction and student loyalty.

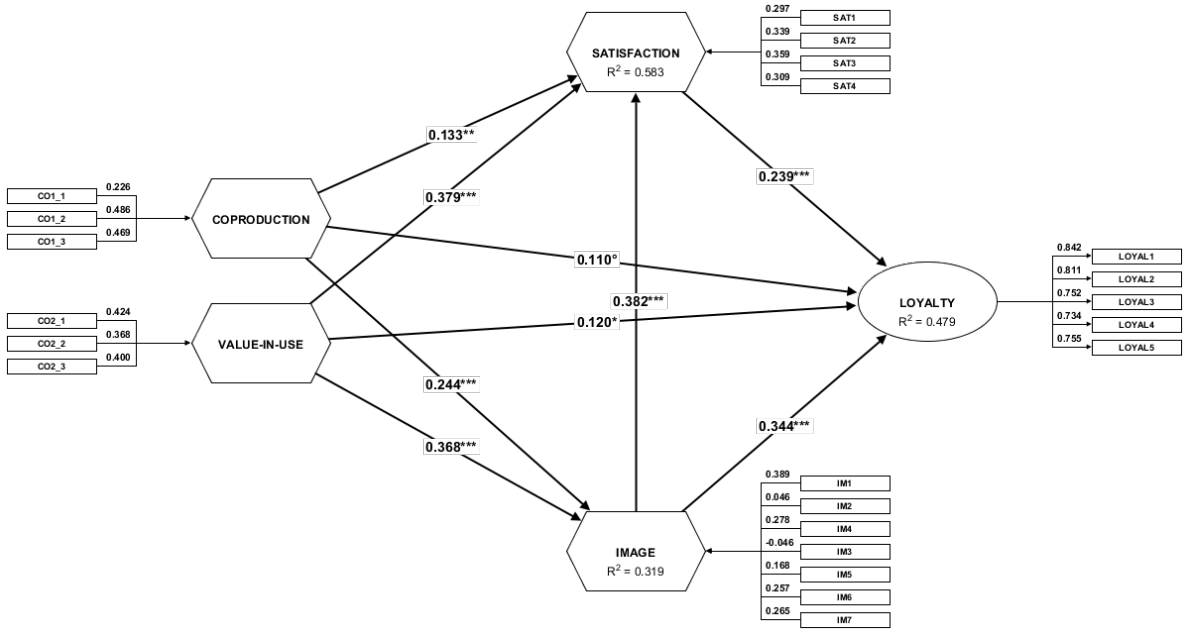

Figure 3 Nomological net and structural model of second-order constructs

Table 3 The hypothesis test of second-order constructs

	Hypothesis	Coefficient	t-values	Sig.	R^2	f^2	Decision
H1a	COPRODUCTION -> SATISFACTION	0.133	3.034	0.002	0.583	0.021	Accept
H2a	COPRODUCTION-> LOYALTY	0.100	1.939	0.053	0.479	0.011	Reject
H3a	COPRODUCTION-> IMAGE	0.244	4.432	0.000	0.319	0.046	Accept
H1b	VALUE-IN-USE-> SATISFACTION	0.379	8.105	0.000	0.583	0.164	Accept
H2b	VALUE-IN-USE -> LOYALTY	0.244	2.006	0.045	0.479	0.011	Accept
H3b	VALUE-IN-USE -> IMAGE	0.368	6.963	0.000	0.319	0.104	Accept

Third-order constructs

Model fit

The SRMR, d_{ULS}, and d_G results are 0.044, 0.292, and 0.158, respectively; whereas the HI99s is 0.029, 0.128, and 0.071, respectively. All results are higher than the HI99s, but the SRMR is below 0.08.

The Measurement Model of the Third-Order Constructs

The current study uses a composite model algorithm and mode B for the third-order constructs. The criteria consisted of the nomological net, multicollinearity, weight, and relevance. The constructed variable has a clear relation in the nomological net context, in which all directions are positive and significant. There is no multicollinearity since the VIFs are between 1.288 and 2.701. Almost all indicators are relevant except for IM2, but the loading exceeds 0.50, which should be retained in the model.

Table 4 Measurement model of the third-order constructs (formative)

Indicator	Dijkstra-Henseler's rho (ρ_A)	Loading	Weight	T-Weight	VIF
Loyalty	0.888				
LOYAL1		0.846	0.262	21.173	1.897
LOYAL2		0.810	0.251	25.541	2.701
LOYAL3		0.756	0.234	24.958	2.623
LOYAL4		0.727	0.225	23.073	2.395
LOYAL5		0.753	0.234	20.295	2.558
Co-creation	1				
Coproduction		0.865	0.386	5.617	1.912
Value-in-use		0.960	0.693	11.061	1.912
Satisfaction	1				
SAT1		0.747	0.274	4.657	1.522
SAT2		0.808	0.336	5.496	1.683
SAT3		0.790	0.357	6.594	1.547
SAT4		0.712	0.339	6.851	1.288
Image	1				
IM1		0.783	0.392	5.845	1.772
IM2		0.657	0.048	0.688	2.001
IM4		0.727	0.244	3.459	1.613
IM5		0.637	0.160	2.562	1.459
IM6		0.690	0.242	3.677	1.452
IM7		0.757	0.286	4.100	1.589

Structural model of the third-order constructs

All path coefficients of the structural model are significantly and positively related. The most reliable paths are co-creation to satisfaction and co-creation to image in terms of the path coefficient, t-value, and effect size. Table 5 and Figure 4 show the information.

Table 5 The hypothesis testing of the third-order constructs

	Hypothesis	Coefficient	t-values	Sig.	R^2	f^2	Decision
H1	CO-CREATION -> SATISFACTION	0.472	12.729	0.000	0.583	0.364	Accept
H2	CO-CREATION -> LOYALTY	0.214	3.838	0.000	0.477	0.044	Accept
H3	CO-CREATION -> IMAGE	0.563	15.191	0.000	0.317	0.465	Accept
H4	IMAGE -> SATISFACTION	0.391	9.565	0.000	0.583	0.251	Accept
H5	IMAGE -> LOYALTY	0.335	6.182	0.000	0.477	0.117	Accept
H6	SATISFACTION -> LOYALTY	0.243	4.019	0.000	0.477	0.047	Accept

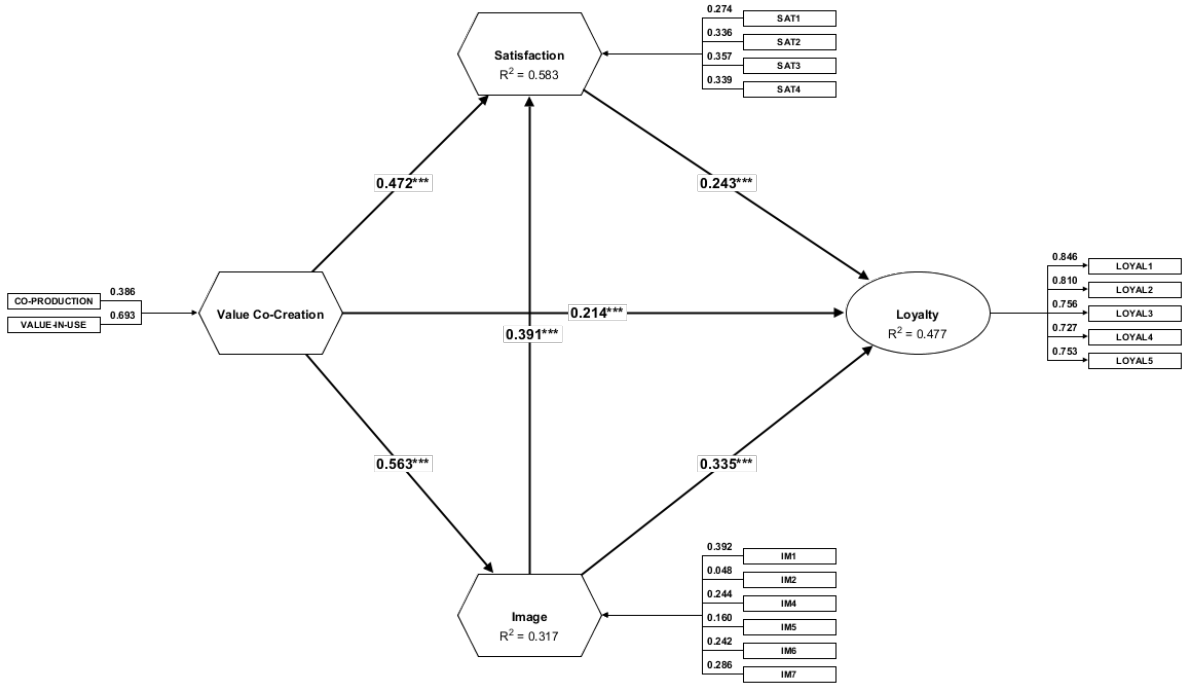

Figure 4 Structural model of the third-order constructs

Conclusion

Hypotheses H1a, H2a, and H3a are the relationships between coproduction and satisfaction, loyalty, and image. The results show that coproduction, not loyalty, positively effects university image and student satisfaction. The effect refers to the coproduction process, particularly, knowledge sharing. Equity and process interaction increase student satisfaction and improve the university's image. Knowledge sharing, equity, and interaction organize coproduction well. Hypotheses H1b, H2b, and H3b are the relationships between value-in-use and satisfaction, loyalty, and image. The results show that value-in-use positively relates to university image, student satisfaction, and loyalty. The results show that the experiences of knowledge sharing and personalization, including the relationship with the university, influence student satisfaction and the university's image.

Experience, personalization, and relationships are well-organized value-in-use. Hypotheses H1, H2, and H3 are accepted, as value co-creation positively relates to student satisfaction, loyalty, and university image. The result applies to the university offering student incentives and conditions to offer suggestions and ideas. Students may share their knowledge, including enhancing the process by experimenting and trying new things. Therefore, a student would appreciate and enjoy their relationship with the university. Thus, value co-creation can affect student satisfaction due to the reputation of university faculty service efficiency and student-student environment interaction. This finding conforms with Dollinger et al. (2018), who found that value co-creation positively relates to student satisfaction. Value co-creation will construct the university's image improving the quality of all course offerings, graduate students, teaching, and research resources. In addition, the university was respected because its

clients spread the right message across their social networks. Therefore, value co-creation will make students care about the university and refer it to their friends or family, which implies student loyalty to the university. This is consistent with what was stated by Ranjan and Read (2016), who found that value co-creation positively relates to student loyalty.

This finding is also in line with Zwass (2010), who found that value co-creation encourages students to commit to another university. He also found value in co-creation in academic competence, graduate students, teaching and research tools, and massification linked to university image. H4 and H5 are accepted as university image positively relate to student satisfaction and loyalty. The results indicate that academic offerings, graduate students, massification, teaching and research resources, and affective image affect the university, which can influence student satisfaction and loyalty. H6 is accepted as student satisfaction is positively related to student loyalty. The results show that university reputation, faculty competence, the service quality of staff, and student-student interaction are well-performing student statistics that influence student loyalty. This conforms to the results of Helgesen and Nesset (2007).

All hypotheses above are the direct effect of the current study. However, there are indirect effects or mediator effects. University image and student satisfaction are mediators with partial mediating effects. The results show that value co-creation, which has direct and mediating effects on student loyalty, plays a significant role in this study. Regarding university image, the perception of costs is not well defined-it includes tuition fees, accommodation costs, and food costs. The results for IM3 suggest that the unreasonably high price is due to its negative sign, and using Ranjan and Read's (2016) university cost indicators could be more effective than the cost of this study.

In general, all studies that use the repeated indicator approach cannot maintain discriminatory validity, resulting in inconsistency, and the model failed to provide an adequate fit (van Riel et al., 2017). However, this work used a two-stage approach with a repeated indicator approach in the first-order construct to obtain the standard construct scores for the second-stage indicators. The extended repeated indicator approach may use fewer first-order constructs (Becker et al., 2012). They constructed the repeated indicator approach without the second-order constructs within the model. The present paper has more first-order constructs, including six, seven, and four for value co-creation, university image, and student satisfaction. The results of Becker et al. (2012) may not provide a parsimonious model. Finally, both approaches yield. The same necessary construct scores (Sarsted et al., 2019).

Practical implications

The result shows that co-creation positively affects university image, student satisfaction, and loyalty. Presently, students are declining due to a more competitive market; thus, universities could make more innovations. Therefore, universities should construct more co-creation processes in many areas of university contexts. Nevertheless, some of the 38 Rajabhat University processes are less based on co-creation, and the number of students is low due to a declining population. Rajabhat Universities will have a significant role in the local

development, and a few universities, which have played essential roles in co-creation, have been active in this new work; as a result, co-creation should be customized to the university-funded projects. Additionally, as enrolment in Rajabhat Universities declines, the universities may become more dependent on the community to provide knowledge services, necessitating a greater emphasis on co-creation methodologies to obtain efficient results.

Theoretical implications

The results show strong relationships between university image and co-creation, student satisfaction, and student loyalty. Therefore, this study confirms the co-creation theory, which states that co-creation positively affects the organizational image, customer satisfaction, and loyalty. Moreover, this study confirms the hypothesis that coproduction and value-in-use are elements of co-creation that have positive relationships with university image and student satisfaction. Value-in-use is favorable to university image, student satisfaction, and loyalty.

In principle, in the PLS-SEM, third-order co-creation should be created, and the second-order university image and student satisfaction should be constructed. Furthermore, co-creation, university image, and student satisfaction are included in the composite model using the composite algorithm and mode B mainly using a reflective-formative type and disjointed two-stage approach.

Limitations and implications for further research

The co-creation of the present paper consisted only of one university and its students. In future research, perfect co-creation would involve almost all stakeholders, including those from at least three groups, namely, the university, students, and employers. For example, Lusch and Webster (2011) suggested a marketing strategy for the co-creation of all stakeholders; and through the research, Valaya Alongkorn Rajabhat University partnered with the Central Group for the new retail management bachelor's degree.

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Appendix

Table A *Questionnaire*

Items
Coproduction (CO1)
Knowledge sharing (CO1_1)
CO11: The university gives me the opportunity and environment to deliver feedback and ideas.
CO12: The university was open to my ideas and suggestions about its existing service or new service.
CO13: The university gave me ample illustrations and information.
Equity (CO1_2)
CO14: Students played a fair role in determining the project result.
CO15: The university had easy access to my interests.
CO16: This university's procedures comply with my criteria.
Interaction (CO1_3)
CO17: During the process, I could communicate my specific requirements conveniently.
CO18: The university provided its consumers with appropriate process-related information.
CO19: The university allowed adequate student engagement in business processes.
Value-in-use (CO2)
Experience (CO2_1)
CO21: Sharing my knowledge was a memorable experience.
CO22: My process experiences can differ depending on the type of student involvement.
CO23: A student may develop the method by testing and trying new things.
Personalization (CO2_2)
CO24: The benefit, value, or enjoyment of the method relied on the student's condition of use.
CO25: The uUniversity tried to serve each student's individual needs.
CO26: Specific students are affected differently based on their preference, choice, or experience.
Relationship (CO2_3)
CO27 :The university's expanded facilitation is essential for customers to enjoy the process truly.
CO28: I felt a university connection or friendship.
CO29: The university was respected because its clients spread the right message across their social networks.
Satisfaction
University reputation (SAT1)
SAT11: My current university is known for its high-quality academic programs.
SAT12: My current university is renowned for its academic programs.
SAT13: My current university offers programs for my educational needs.
Perceived faculty academic competence (SAT2)
SAT21: The faculty members care for students.
SAT22: Faculty members have a sincere interest in solving problems for students.
SAT23: The faculty members show a positive attitude towards students
SAT24: Faculty members are highly competent in their subject matter.
Perceived service quality of staff (SAT3)
SAT31: The staff helps a good-mood client.
SAT32: The staff has a high quality of student service.
SAT33: The staff’s service communicates effectively.
Student-student interaction (SAT4)
SAT41: There is good teamwork among students in assignments.
SAT42: Students communicate well during in-class course activities.
SAT43: Support from college clubs/unions of students is quick.
University Image
Perception of the academic offerings (IM1)
IM11: Offers a wide variety of university courses.
IM12: Offers labor market-requested courses.
IM13: The education provided cultural and intellectual enrichment.

Items
Perception of graduate training (IM2)
IM21: The university has high-quality teaching.
IM22: The university has successful internships.
IM23: The teaching standard needed for the labor market is met.
Perception of costs (IM3)
IM31: The tuition is fair.
IM32: The university housing is fair.
IM33: The university food is fair.
IM34: All university costs are fair.
Perception of massification (IM4)
IM41: Appropriate number of students per class.
IM42: The number of staff is sufficient.
IM43: Appropriate student/teacher ratio.
Perception of teaching resources (IM5)
IM51: Study resources like the library and computers are appropriate.
IM52: The study materials like computers are modernized.
IM53: The faculty members are good teachers.
Affective image (IM6)
IM61: Agreeable
IM62: Stimulating
IM63: Relaxing
IM64: Cheerful
Perception of research resources (IM7)
IM71: The faculty members are good researchers.
IM72: The faculty members are career qualified.
IM73: The research materials are appropriate.
Loyalty (LOY)
LOY1: The university impresses me.
LOY2: I will refer this university to my friends/family.
LOY3: I care about the university.
LOY4: I usually post my impressions of the university' on social media.
LOY5: I would rather study more at this university.