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Customer Journey Clue-based Service Failure Prevention

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Abstract

Customers and their perception towards service are considered as a determinant of service failure, and so, service failure and its prevention must be looked into from the perspective of the customers. This paper presents a customer-centric service failure prevention framework, which aims to provide a holistic way of service failure prevention by integrating service delivery assessment and failure analysis from a customer perspective, encompassing failure identification, assessment and prioritization of failures as a basis for corrective actions. Customer journey, service clues, and customer oriented-FMEA are employed to develop the proposed framework. The approach was applied to an enrolment process showing that using customer journey assists in determining customer processes, needs, wants and touch points in the service, and when used together with service clues further facilitates systematic and effective unveiling of potential failures that are important to customers. Assessment of failures and its prioritization with customer perspective leads to better prioritization that is reflective of the voice of customers. The case study shows that higher risk is imposed by actions emanating from the employees, reinforcing further that service failures not only concern functionality of the service but equally important also are the encounter of customers with service employees and the environment.

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1. Introduction

The society now is becoming predominantly service-based. Service sectors such as healthcare, finance, banking, education, retail, transportation, infrastructure, food and restaurant, hotel and tourism are now becoming prevalent in the market. Indeed, more and more people are now utilizing services, and even businesses themselves employ services from other companies, making service an integral and crucial part of today's global economy (Fitzimmons and Fitzimmons, 2011). The growth of service industry becomes a challenge for companies having the same business offerings. A company must differentiate itself from others to be competitive, and the ability to offer superior service is well recognized as a major differentiator in the competitive market (Shin et al., 2017). Even manufacturing firms are leveling up their competitive advantage by offering a variety of services to their customers (Gronroos, 1988), acknowledging that product quality and price are no longer the only two factors considered by customers in their buying decision (Antonacopoulou and Kandampully, 2000). Businesses strive to provide better, more customer-focused service (Bailey, 1994) that meets or exceeds the customer expectations (Miller et al., 2000). In so doing, it will gain companies a competitive edge by attracting and retaining customers, which is important to the success of the business (Mattila,

2001), and increase in profitability (Reichheld and Sasser, 1990). However, the inevitability of service failures proved to be a challenge to businesses.

The inevitability of service failure could be attributed to the nature of service, which is different from tangible products. Service is intangible and consumed at the time it is produced; hence, its quality cannot be tested before the release of the service to the customers; unlike tangible products wherein quality can be measured and tested prior to release to the market. The only way the quality of service can be discerned is by the judgment of the customers to the service during its performance; hence, providing a failure-free service becomes a challenge. Service is an offering provided as a solution to customer problems, which consists of a series of actions that normally occur in interactions between customer and employees and/or physical resources and/or systems of the service provider (Gronroos, 1990). Service exists when customers avail it to fulfill their needs and wants. It normally occurs in the domain of the service provider and includes the interaction of customers with the employees and the environment, which usually takes longer than buying a product. The more time spent by customers in the service, the more time is also spent evaluating and forming a judgment on the service. When the service falls below or does not meet customer expectations, the service constitutes a failure (Michel, 2001, Chuang, 2007).

Whether the expectations of customers are fulfilled or met, and whether they had good interactions with employees and environment forms the overall perception of the customers on the service. A negative perception in all or any of these could lead to a drop in the satisfaction of the customers. Service failure is any situation arising from the service encounter that leads to the unhappiness of the customers.

Service failure is detrimental to service firms. The customer dissatisfaction arising from service failure could potentially lead to a domino effect for the company. A disgruntled/dissatisfied customer could initiate a negative word of mouth which could further lead to other unfavorable scenarios for the company such as poor reputation, loss of sales opportunities and potential loss of future customers (Bailey, 1994). Customer switching and defection (Keaveney, 1995 and Miller et al., 2000) arising from mistakes in service or unmet expectations could significantly hurt the profitability of firms.

The occurrence of service failure may be mitigated by the conduct of recovery efforts which can help the company make up for the mistake made and provide an opportunity for the company to gain customer trust and confidence back. However, aside from associated unexpected service costs during recovery efforts (Sutrisno and Lee, 2011), some studies show that recovery efforts may not be at all reliable and successful. It was found that despite being satisfied with the recovery process, some customers still choose to leave the company (Colgate and Norris, 2001), implying that the occurrence of the service failure itself is reasoned enough for leaving the company. Importantly, service recovery efforts in some situations may not happen in the first place at all, as many dissatisfied customers silently switch providers or instigate a negative word of mouth rather than express dissatisfaction to the company following a service failure (Tax and Brown, 1998). In addition, it was discerned that companies perform better in the eyes of the customer by avoiding service failure than by responding to failure with superior recovery (McCollough et al., 2000).

The disadvantageous effects of service failure and the costly and unassured success of recovery efforts are evident enough for companies to concentrate on preventing service failures from happening at all. To gain a competitive edge and to attract and retain customers, a company must strive to provide a service that would provide satisfaction to the customers, one that is free from failure. Service failure prevention, therefore, is a crucial matter in the service sector that needs to be addressed even though it is hard to achieve (Geum et al., 2011).

Service failure prevention is considered as a proactive approach of treating the system by identifying, evaluating failures and improving the system (Geum et al., 2011). Failure Mode and Effect Analysis (FMEA) is a famous reliability tool in failure prevention of products. But it is now slowly gaining popularity in the context of failure prevention in service settings, such as in medical and hospital services (Chiozza and Ponzetti, 2009; Geum et al., 2011); hypermarket service system (Chuang, 2007, Chuang, 2010); travel (Shahin, 2004); and entertainment (Charoenchokdilok and Koomsap, 2018).

These studies typically carried out the FMEA process following the traditional steps, which includes: (1) identification

of potential failure modes by reviewing the service process; (2) assessment of failure modes in terms of severity, occurrence and detection; (3) prioritization of failure modes; and (4) recommendation of corrective actions. However, as observed, the herein processes are mostly conducted from a service provider perspective, and not from a customer perspective. In service, the importance of conducting failure prevention processes from customer perspective cannot be underestimated. Identification, assessment, and prioritization of failures conducted mainly from manufacturer perspective may not significantly address the criticality of service failure. In fact, Shahin (2004), and Koomsap and Charoenchokdilok (2016) illustrated that with and without customer perspective resulted in different prioritization. Similar to service quality and satisfaction, customer perception is a major factor that determines whether a service failure occurred (Chuang, 2007 and Goldstein, 2002). Despite the best efforts of the company, in the end, it is still the customers who availed of the service will determine whether a failure has occurred. Therefore, it is important that service failure is viewed from the customer perspective. The unhappiness or problem that a customer perceives in relation to service is what a company needs to recover from (Geum et al., 2011).

The customer-oriented FMEA by Shahin (2004) and Koomsap and Charoenchokdilok (2016) has brought in a new perspective in assessment and prioritization in the FMEA. In this new approach, the perception of customers on failure modes and customer dissatisfaction are considered as factors in the criticality of failures in the system, thus believing to result to better prioritization reflective of the voice of the customers. However, even with the advent of customer-oriented FMEA whose risk prioritization already considers the customer perspective, it still is not customer-focused enough. It lacks a better assessment of service delivery from a customer perspective and clear and systematic identification of potential service failures.

Chuang (2007) illustrated the use of service delivery assessment through service blueprint combined with FMEA as a way to assist in designing a failure-free service system. A service blueprint is a map of all transactions constituting the service delivery process (Shostack, 1984). However, some authors have argued that the service delivery process in the service blueprint may not really be mapped from customer perspective and only involves the processes that the company envisions the customers will go through (Johnston, 1999). Bitner et al. (2008) also raised concerns about the potential lack of customer focus using service blueprinting. Furthermore, Halvorsrud et al. (2016) claimed that there are deviations from what a company expects from the delivery of service and from what the customers really experienced. How a company views service may vary from how the customers view it. Therefore, another way of service delivery assessment must be investigated in conjunction with service failure prevention, one that is reflective of customer's perspective to have a deep and thorough understanding of how customers see the service.

The importance of the identification of potential failures must be given emphasis as well. The ability to unveil all potential failures as seen by customers is essential, considering

that the rest of the steps in FMEA depends on the potential failures that are identified. Unidentified potential failure cannot be assessed accordingly and more so cannot be included in prioritization and corrective actions later on. Hence, the question now is how can potential failure be systematically identified? Is there a systematic way that can guide and steer the service providers to proper identification of service failures that are important to customers?

Presented in this paper, therefore, is a customer-centric service failure prevention approach that covers service delivery assessment and failure analysis from a customer perspective.

2. FMEA and its application in service

Failure mode and effects analysis (FMEA) is a process of identifying potential failures before they occur in order to eliminate them from the system (Ambekar, 2013; Sankar and Prabhu, 2001). The FMEA is typically carried out by a cross-functional team and the procedure of which traditionally involves four steps (Liu et al., 2012). First is the identification of all potential failure modes in the system. Second is the analysis of the potential failures according to its occurrence (O), severity (S) and detection (D) and assignment of scores and rating according to some evaluation criteria. Occurrence pertains to the probability of the failure to occur. The higher the probability of occurrence of a failure is, the higher the score will be. Severity refers to the seriousness of the effect of the failure. The more hazardous the effect is, the higher the score is given. On the other hand, the detection score is assigned based on the probability of not detecting the failure. A higher score will be assigned for failures that have a low likelihood to be detected. After scoring, prioritization of failure modes is then determined through the Risk Prioritization Number (RPN) which is a product of O, S, and D rating. Failures with a high probability of occurrence, high severity effect, and low detection capability are considered to be critical failures. Lastly, corrective actions are recommended and applied to high-risked failure modes.

Traditionally, FMEA has been conducted according to manufacturer perspective until recently that customer perspective has been incorporated in FMEA in separate studies by Shahin (2004) and Koomsap and Charoenchokdilok (2016). The concept of customer-oriented FMEA arises from the observation that customers are the ones who are directly affected by the occurrence of failure and how they perceive the effects of failure may differ from the manufacturer or provider, leading to different prioritization with and without customer involvement; therefore, their viewpoint must be considered in the FMEA process.

Shahin (2004) initiated the concept of customer-oriented FMEA by integrating Kano and FMEA. In his study, he argued that severity is consistent with customer dissatisfaction and non-fulfillment of customer needs is consistent with the frequency of failure. Following the study of Tan and Shen (2000), which proposes that satisfaction (s) is proportional to product performance (p): $s = cpk$, with k values representing product attributes, Shahin presented a reversal to get customer

dissatisfaction. In his proposal, satisfaction is replaced by severity (S) which is compatible with customer dissatisfaction as argued by Shahin. Performance is replaced by an occurrence of a failure (O), and the constant is replaced by detection (D) which is assumed as independent of O and S and therefore remains constant. These assumptions led to the development of a mathematical model of severity as proportional to detection and power function of occurrence to k , with k representing the reverse attributes taking values of 2, 1, 0 and -1 for reverse must be, reverse one dimension, indifferent and reverse attractive:

$$S = DO^k \quad (1)$$

The reverse Kano model was utilized to classify customer dissatisfaction into the reverse attributes. In the reverse Kano, the recorded row-column order for each pair of questions in the Kano evaluation table was modified from positive-negative questions to negative-positive questions.

Using the equation for severity, a customer oriented RPN by Shahin is then described as follows:

$$RPN_c = SOD = D^2O^{k+1} \quad (2)$$

Koomsap and Charoenchokdilok (2016) also supported the view of integrating customer perspective in FMEA but did improve on the customer-oriented FMEA based on the following points. First, severity should not be a function of occurrence but should be dependent upon the nature of failure mode, instead. Second, both occurrence and severity influence customer dissatisfaction. Third, severity should not be a function of detection because detection does not alleviate the severity. In fact, the corrective actions do. Fourth, severity should not be influenced by the attribute of dissatisfaction. For example, a dangerous task is not severe because customers are experts and feel indifferent about it. Last but not least, severity is a crucial factor, but can only indirectly influence RPN, which is dominated by an occurrence. Their customer-oriented FMEA focuses on customer dissatisfaction, instead of severity, and a new RPN calculation is built around it.

Accordingly, failure modes are poor performance of a product that causes customer dissatisfaction. The dissatisfaction is absent when failure is absent, but the time that failure becomes present, dissatisfaction occurs. Thus, customer dissatisfaction is a function of occurrence. However, the degree of dissatisfaction is dependent on the severity of the failure mode. A serious failure leads to higher dissatisfaction. Therefore, customer dissatisfaction is both a function of occurrence and severity, but severity has more influence on customer dissatisfaction than occurrence. However, customer dissatisfaction does not always have a linear and symmetric relationship with severity, as shown in figure 1. For some service attributes for which customers have a high expectation that failure will not occur, the occurrence of a failure with high severity can lead to high dissatisfaction of customers, but a low severity will not lower the dissatisfaction significantly. These are considered as failures that they cannot accept. On the other hand, some failure modes that customers can accept will result to different dissatisfaction level. Because they expect that failure may occur in this particular aspect when the failure occurs

with high severity, it will cause them a bit of dissatisfaction but not too high; and the nonoccurrence of failure will make customers very satisfied.

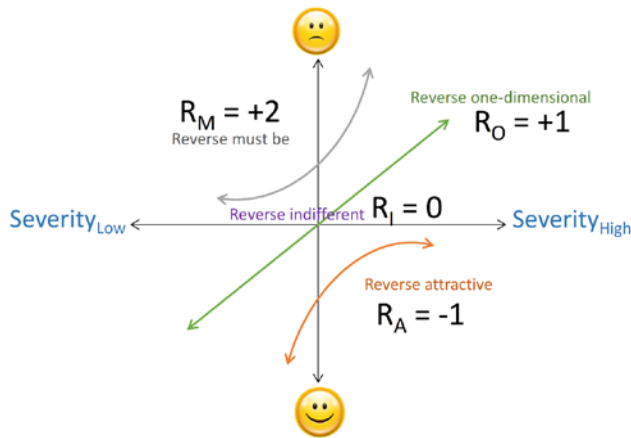


Fig. 1. Customer dissatisfaction attributes (Koomsap and Charoenchokdilok, 2016)

The customer dissatisfaction is proposed to be proportional to the occurrence and power function of severity to k .

$$U = W_o OS^k \quad (3)$$

Further, the risk of failure is dependent on the degree of customer dissatisfaction and the probability that failure can be detected, thus,

$$RPN_c = W_D DU = W_D W_o DOS^k \quad (4)$$

W_D is the ratio between the weight given to detection (w_d) and the weight given to severity (w_s); W_o is the ratio between weight given to occurrence (w_o) and the weight given to severity.

The steps in customer-oriented FMEA is similar to that in traditional FMEA, with some additional step on the conduct of Kano survey. A team will first decompose a product's function. The team will next identify possible failure modes and assess severity, occurrence, and detection. Reverse Kano survey will be conducted to get customer dissatisfaction attributes and corresponding k values. The results from both the assessment and the survey will be combined for prioritizing the risks. The RPN calculation will be done using equation (4).

Although the customer-oriented FMEA already considers the customer perspective in terms of assessment and prioritization of risks, the assessment of service delivery and identification of potential service failures are still not addressed in this process.

Thus, the question remains, how to attain a holistic customer-centric service failure prevention framework that not only assess and prioritize risk using a voice of customers; but also takes into account assessment of service delivery and identification of failures from the customer perspective?

3. Customer Journey Clue-Based SFP

In service, it is a customer's perception that determines whether a service fails or not, despite a company's best efforts to provide the highest quality (Harvey, 1998). Thus, it is only

fit to view service failure and its prevention from a customer's perspective. As such, this study presents a customer-centric service failure prevention framework that integrates assessment of service delivery and failure analysis from a customer perspective.

The main concept of the framework as illustrated in Figure 2 is to provide a means to effectively unveil all potential failures in the service by understanding how customers assess the service and what aspects of the service do they form their perception; followed by assessment and prioritization of the failures taking into consideration the voice of the customers in the analysis. Thus from identification to assessment to prioritization, customer perspective is considered. With this framework, the failures that are important to customers would be given priority in corrective actions.

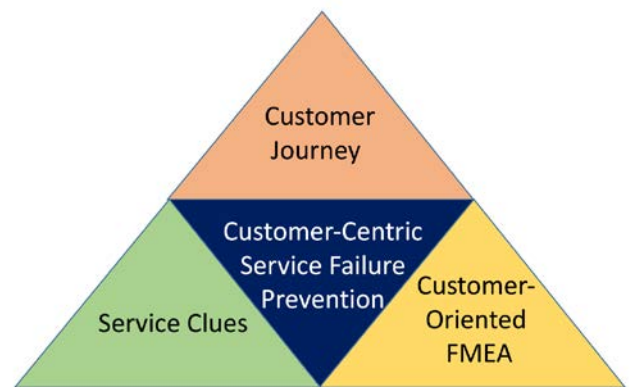


Fig. 2. Three key elements of customer-centric service failure prevention framework

The customer-oriented FMEA has already considered the customer perspective in assessment and prioritization of failures, but as pointed out it still lacks customer perspective when it comes to identification of failures. Thus, customer journey and service clues are introduced to address this aspect.

Customer journey (CJ) is a process, which a customer goes through to achieve a specific goal and may involve touchpoints or moments of interaction between customer and service provider; and actions or customer activities (Folstad et al., 2013). Service blueprint and customer journey may be similar in terms of the fact that it shows the processes that customers undergo in the service, but they differ significantly on which perspective the process was mapped accordingly. The literature claims that in service blueprint, the process is mapped according to how the service provider sees it but in the customer journey, the process is mapped according to the actual process that customers go through. In customer journey, the focus is on the customer. The concept of customer journey has been explored in a variety of application, especially in terms of service and customer satisfaction improvement in a variety of services, such as in library services (Andrews and Eade, 2013) and public sector services (Crosier and Handford, 2012). In addition, the concept of CJ was also used to identify deviations that occur in the actual journey of customers compared to a planned journey, thus, revealing problematic and inconsistent delivery in the service (Halvorsrud et al., 2016). CJ was

also used together with the four realms of experience (4Es) to create a memorable customer journey and improve loyalty (Hussadintorn Na Ayutthaya and Koomsap, 2018).

The customer journey – its associated actions, touchpoints and expected outcomes – provides the company understanding on customer needs, how customers experience the service and most importantly what components of the service that customer are most likely to encounter and the outcomes they seek, which becomes the basis for their assessment of the service.

Aside from understanding the journey, it is also important in this framework to understand what aspects of service that customers form their perception. Is it just the outcome of the service or is there something else? According to the study of Oliver and Rust, (1994), customers evaluate the service according to three components: the interaction between customer and employee, the outcome of the service, and the service environment. This is similar to the study of Berry et al. (2006) which indicated that customers evaluate services according to three clues that are embedded in service performance. These clues are the functional clue – the technical performance or the core of the service; the humanic clue – the appearance and behavior of the service providers; and the mechanic clue – the setup and tangibles of the service. The performance of these clues forms the overall perception of the customers in the service. Hence, if poor performance and/or mistakes on any or all of these clues occurred, the perception towards service will take a downfall. Failure can arise from any or all of the following: unreliability in the service offering – the needs and wants of customers are not met, the service provider does not perform well, and the setup is not good. The use of service clues is essential in identifying the potential failures according to the functional, humanic and mechanic aspects of the service, considering that perception towards service are based on the performance of these clues.

It can be observed that the customer journey and service clues complement each other in this case. Potential failures according to functional clues can be derived from anticipating nonfulfillment of the expected outcomes of the customer as defined in the journey. On the other hand, potential failures according to humanic clues could be based on the negative performance of the encounter with the employee, which refers to the human touchpoints in the journey. Lastly, potential failures according to mechanic clues can be derived through anticipation of negative or poor representation of the service environment or faulty facilities/ physical resources associated with the service, which refers to nonhuman touchpoints outlined in the journey.

The assessment of service delivery and failure identification through customer journey and service clues make up the first two stages of the framework as shown in Figure 3. The five stages of the customer-centric service failure prevention framework, and how they can be performed are discussed next in detail.

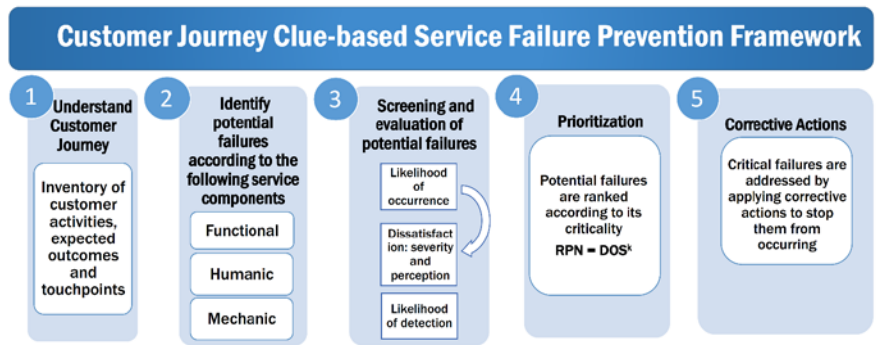


Fig. 3. Customer journey clue-based service failure prevention framework

Stage 1 and stage 2 address the service delivery assessment and failure identification from a customer perspective. As can be seen in Figure 3, the first stage involves the understanding of the customer journey which entails (1) inventory of activities that customers undertake throughout the service in order to reach his/her goal – this may involve main activities and sub-activities, where applicable; (2) identification of the expected outcomes of the customers in each activity; and (3) specification of touchpoints or interactions that customers encounter in the service that can be human-human interaction, human-nonhuman interaction or both.

Clues are anything that is perceived by the customers in the service. These are things that they can sense and feel, and thus becomes a basis for their evaluation of the service. The feeling of non-satisfaction in service would emanate from the non-performance of these clues. Thus, in the second stage, the potential failures according to functional, humanic and mechanic clues are then identified based on the journey defined in stage 1. As shown in Figure 4, to elucidate the potential failures according to functional clues are investigated by using the expected outcomes of the customer in each activity. The expected outcomes are the needs and wants that the customers want to be fulfilled, and the customer's satisfaction with the service is dependent on the fulfillment of these needs. Non-fulfillment of these needs and wants would result in failure of the service according to its function. On the other hand, the touchpoints, which are the interactions of customers with service employees and/or with the service environment/facilities/physical resources/systems could help the service provider determine what could go wrong in terms of the interaction of the customer with the employee and that of the service environment and its associated facilities and resources. Negative or poor behavior and performance of service employees, such as being rude or impolite, towards customer could lead to dissatisfaction to customers, as most researches have claimed (Keaveney, 1995). The service environment and its facilities influence the customer's perception of the service as well. Poor or negative representation/performance of the service environment and its physical facilities could detract the customer's satisfaction towards the service.

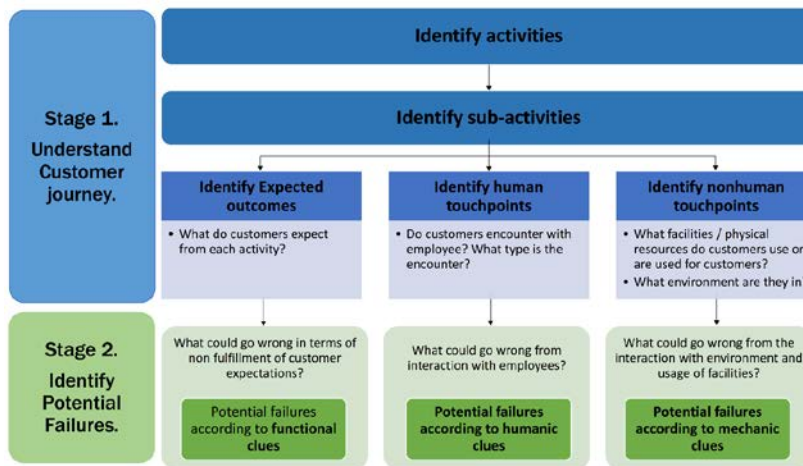


Fig. 4. Detailed flow for stage 1 and 2

Let us take for instance the journey of a customer when availing food from a fast food restaurant as shown in Figure 5 to illustrate stage 1 and stage 2 of the framework. One activity of the customer would be to give an order to the cashier. He/she expects that his/her order is available and can be served in a fast manner (considering that it is a fast food restaurant). Talking to the cashier would serve as a human-human touchpoint, and the presence of the customer in the store itself is considered as a human-nonhuman touchpoint.

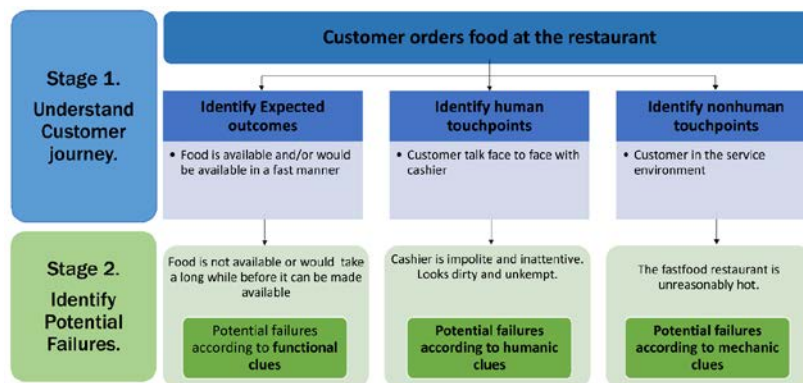


Fig. 5. Illustrative Example for stage 1 and 2

Once the journey is defined, potential failures can then be identified based on the journey. Unavailable food or food taking a long while to be available is considered as non-fulfillment of customer expectation and thus is considered a potential failure according to functional clues. Talking with the cashier can generate failure from humanic clues. A cashier who is grouchy, rude, not paying attention and looks dirty could be a potential failure and could affect the evaluation of the customer in the service. Lastly, being in the environment could trigger pleasant or unpleasant feeling for customers. A potential negative feeling could result from a hot and uncomfortable environment, and thus can be considered as a failure according to mechanic clues.

As can be observed from doing stage 1 and stage 2, the service is being assessed from a customer perspective – their activities, their needs and their encounter with the service – are

taken into consideration. Furthermore, failures are identified with the customers in mind as well, specifically in terms of how they evaluate and perceive service based on some aspects. Stage 1 and 2 show a customer-centric way of assessing service and failure identification as part of the service failure prevention methodology.

Once all potential failures are identified, the third stage on screening and evaluation of potential failures can then be performed. The third stage requires assessing the risk of failure according to some criteria because not all failures are deemed equal. Some failures have lower chance or frequency of occurrence, and some have a high chance. Regardless, the occurrence of failure itself leads to dissatisfaction. However, the extent of dissatisfaction depends on the nature of the failure itself coupled with the magnifying, subduing or negating the effect of the perception of customers to the failure.

Customers consider some failures unacceptable and some as nothing, being that customers have individual nature and perceive things differently. Thus, in this stage, each of the potential failures is assessed according to its likelihood of occurrence, the likelihood of its detection before it can occur, and severity effect. In addition, customer perception to failure is determined through the conduct of Kano survey, by asking customer’s reaction to pairwise positive-negative service situations. The pairwise responses are then applied in the Kano evaluation table, seen in Table 1, which would determine the reverse attribute of each failure mode and thus corresponding k values can then be assigned. In the table, RM is a reverse must-be attribute, RO is reverse one dimension attribute, I is indifferent attribute, and RA is reverse attractive attribute.

The fourth stage is the prioritization of the failures which involves ranking of the failures according to criticality. The failures which are considered critical are those that can provide a very high dissatisfaction to customers and have a very low likelihood to be detected. Using the output of stage 3, following the customer-oriented FMEA, the risk prioritization number of each failure can be computed from the equation:

$$RPN_c = DOS^k \tag{5}$$

The fifth and last stage is the recommendation of corrective actions for the failures according to their criticality. For each of the failures, the potential cause is identified first, and corrective actions are recommended accordingly. The corrective actions would depend upon the failure itself and its potential cause. Considering that from stage 1 and stage 2 the nature of the failure has explicitly defined whether it is functional, humanic or mechanic, the corrective actions are recommended accordingly to such nature.

Table 1. Reverse Kano evaluation table

		(Positive) How do you feel when a failure does not occur to you?				
		Delighted	Satisfied	Neutral	Dissatisfied	Frustrated
(Negative) How do you feel when a failure mode occur to you?	Delighted					
	Satisfied					
	Neutral	R _A	I	I		
	Dissatisfied	R _A	I	I		
	Frustrated	R _O	R _M	R _M	R _M	

The proposed framework illustrates a customer-centric approach in service failure prevention, from the assessment of the service to the identification of failure, its assessment, and prioritization. With this framework, failures considered important to customers, who are considered as determinants of service failure, are effectively identified, assessed and prioritized; and thus, can be properly addressed and corrected with the recommendation and subsequent application of corrective actions.

4. Application of customer journey clue-based service failure prevention in enrolment service

This section illustrates the use of the proposed customer journey clue-based service failure prevention framework to a student enrolment process of a university located in Southern Philippines. The enrolment was chosen because it can be considered as a high contact service with customers having several interactions with different staffs of a service provider and

the desired outcome is purely intangible in nature and relies on the performance of the service provider to the customers.

The enrolment process mainly involves the academic loading of subjects, payment of fees, subject validation, enrolment registration and printing of the certificate of registration (COR). In the first stage, the customer journey of the students during the enrolment process was created. The sub-activities undergone by the students were identified by an interview with final year students. The obtained activities were further clarified with the assessment and registrar staffs. In the shoes of students, expected outcomes were then identified, followed by the identification of touchpoints from the interactions of the students with the staffs, the environment, and resources. The results of the first stage are illustrated in Figure 6.

After obtaining the journey, potential failures were then identified. The potential failures associated with functional clues were derived from the anticipation of non-fulfillment of expected outcomes. The potential failures associated with humanic and mechanic clues were identified from the anticipation of the negative encounter with employees and the environment. Table 2 presents the results of the first two stages in detail. The obtained potential failures were further examined, consolidated and analyzed. A total of 22 potential failures were identified from the process, 15 of which are according to the functional aspect, 4 according to the humanic aspect and 3 according to the mechanic aspect, as listed in Table 3.

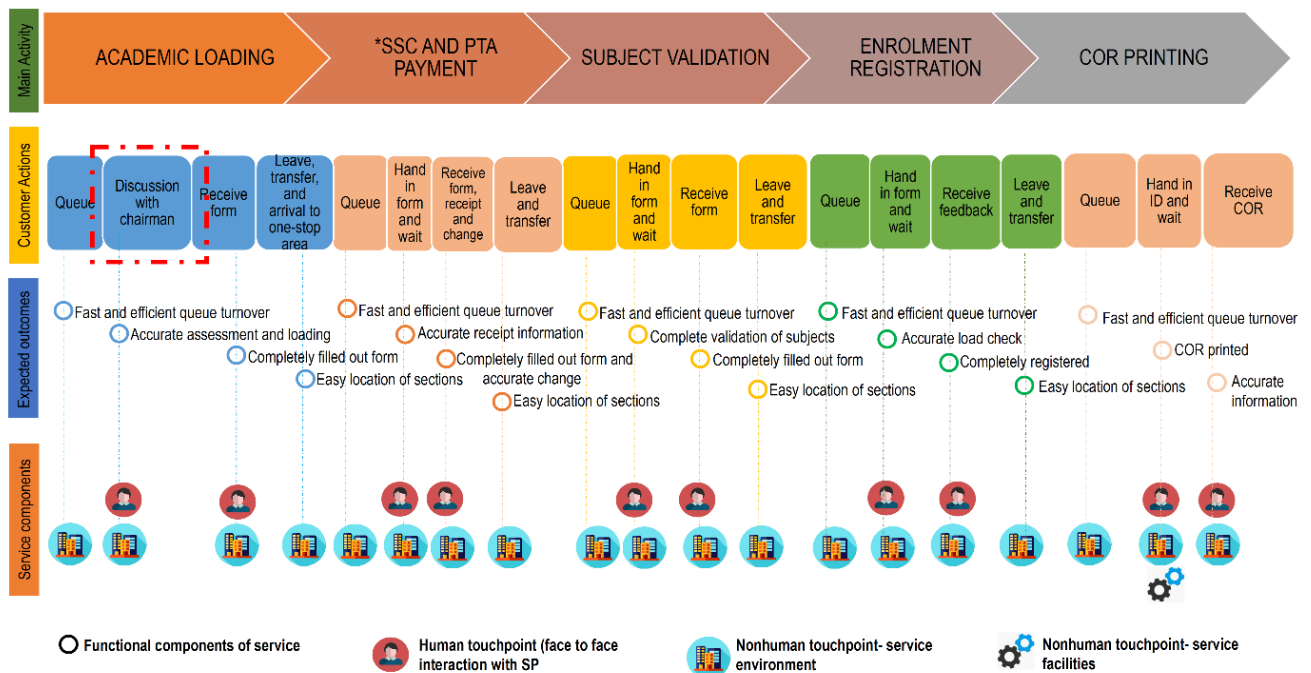


Fig. 6. Customer journey of the students in enrolment process

Once the potential failures were finalized, customer-oriented FMEA was conducted. Surveys were conducted to determine the values for occurrence, detection, severity and customer perception to failure. The students were asked to answer the questionnaires for severity and customer perception because

they were considered as the recipients of the service and thus they were the one who would react in case a certain service failure occur to them. The survey on severity got 122 responses while Kano survey on the customer perception to failure got 128 responses. On the other hand, the detection and

occurrence questionnaires were answered by the university staff because they were the one delivering the service and they could better assess how often a certain failure occur among the many students they had served throughout, and they could also better determine how easy to detect a failure. There were 25 staffs participated in the survey, specifically 11 department chairmen, 4 registrar staffs, 4 assessment staffs, 3 PTA/SSC staffs, and 3 ICT staffs.

The occurrence questionnaire aimed to measure the frequency of occurrence of failures and respondents were asked to rate it from 1 to 9, 1 being unlikely and 9 being high number of occurrence. The severity questionnaire aimed to assess the effect of the failure to dissatisfaction of customer and is ranked 1 to 9 with 1 as having no effect and 9 as having hazardous effect. The rating scale was adapted from Geum, et al. (2011). The detection questionnaire aimed to determine the likelihood that

failure could be detected, with rating of 1 for almost certain to be detected and 9 for absolutely uncertain to be detected. In this case, the rating scale was adapted and modified from Koomsap and Charoenchokdilok (2016). The reverse Kano questionnaire was created by transforming the potential failures to pairwise positive and negative questions and aimed to measure the students' reaction towards these as being delighted, satisfied, neutral, dissatisfied, and frustrated. The reverse Kano evaluation table was used for analysis to determine the reverse attribute of each failure mode. Similar to occurrence, severity and detection analysis, where mode statistics was used, the pairwise response with highest frequency was being considered. The failures were prioritized accordingly by calculating their risk prioritization numbers using the equation 5. The results are shown in Table 4.

Table 2. Customer journey and potential failures

Customer Activities/Actions	Expected Outcomes	Potential Failures According to functional clues	Touchevents (Humanhuman)	Potential Failures According to Humanic clues	Touchevents Human to nonhuman	Potential Failures According to Mechanic clues
1) Academic Loading						
1.1 Queue outside chairman's office	The student take his/her turn in the queue in a lasi and orderly manner	Queue is long and unorganized			Queue environment	Queuing area is hot and uncomfortable
1.2 Hand -in enrolment form and discuss with the chairman the academic status, eligibility for enrolment, and subjects to be enrolled	The chairman has accurately assessed the academic status and eligibility for enrolment of the student	The chairman inaccurately assessed the academic status of the student as "not culled" and allowed him/her to enroll even if he/she is not eligible to enroll. The chairman inaccurately assessed the academic status of student as "culled*" and prevent the student from enrolling even if the student is eligible to enroll.	Student Chairman	Chairman is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Office environment	Office area is hot and uncomfortable
	The chairman has accurately and completely "load" the preferred subjects and schedule of the student	The subjects are not created in the system (transaction did not complete). The subjects and schedule are different from the preferred ones as discussed with the chairman				
	The chairman has carefully checked the prerequisites of the subjects	The chairman allowed the student to enroll subjects with prerequisites that has not yet been complied by the student.				
	The chairman has enrolled the student within the allowable number of units	The chairman failed to enroll the student within the allowable number of units				
1.3 Receive back enrolment form	Enrolment form is completely and accurately filled out	The enrolment form is inaccurately and incompletely filled out	Student Chairman	Chairman is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Office Environment	Office area is hot and uncomfortable
1.4 Leave and transfer to one- stop enrolment area	The assigned sections are easily spotted	Difficult to spot the correct line/section			Service Environment	Area is hot and crowded
2) SSC payment						
2.1 Queue in SSC section	The student take his/her turn in the queue in a fast and orderly manner	Queue is long and unorganized			Queue environment	Queuing area is hot and uncomfortable
2.2 Hand-in enrolment form and payment and wait while receipt is prepared	Receipt shows correct information	Receipt shows wrong amount	Student-staff	Staff is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Service Environment	Service area is hot and uncomfortable
2.3 Receive back enrolment form and receipt (and change, where applicable)	Enrolment form is completely and accurately filled out Receipt is provided Amount of change is correct	The form is inaccurately and incompletely filled out Receipt is not given Amount of change is inaccurate	Student-staff	Staff is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Service Environment	Service area is hot and uncomfortable
2.4 Leave and transfer to next section	The assigned sections are easily spotted	Difficult to spot the correct line/section			Service Environment	Area is hot and crowded

Customer Activities/Actions	Expected Outcomes	Potential Failures According to functional clues	Touchpoints (Humanhuman)	Potential Failures According to Humanic clues	Touchpoints Human to nonhuman	Potential Failures According to Mechanic clues
3) PTA payment						
3.1 Queue in PTA section	The student take his/her turn in the queue in a fast and orderly manner	Queue is long and unorganized			Queue environment	Queuing area is hoi and uncomfortable
3.2 Hand-in enrolment form and payment and wait while receipt is prepared	Receipt shows correct information	Receipt shows wrong amount	Student-staff	Staff is Impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Service Environment	Service area is hot and uncomfortable
3.3 Receive back enrolment form and receipt (and change, where applicable)	Enrolment form is completely and accurately filled out Receipt is provided Amount of change is correct	The form is inaccurately and incompletely filled out Receipt is not given Amount of change is inaccurate	Student-staff	Staff is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Service Environment	Service area is hoi and uncomfortable
3.4 Leave and transfer to next section	The assigned sections are easily spotted	Difficult to spot the correct line/section			Service Environment	Area is hot and crowded
4) SUBJECT VALIDATION						
4.1 Queue in Assessment Section	The student take his/her turn in the queue in a fast and orderly manner	Queue is long and unorganized			Queue environment	Queuing area is hot and uncomfortable
4.2 Hand-in enrolment form and wait while subjects are validated	Validation is completely and accurately performed	Validation status is not updated	Student - staff	Staff is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Service Environment	Service area is hot and uncomfortable
4.3 Receive back enrolment form	Enrolment form is completely and accurately filled out	The form is inaccurately and incompletely filled out	Student-staff	Staff is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Service Environment	Service area is hot and uncomfortable
4.4 Leave and transfer to next section	The assigned sections are easily spotted	Difficult to spot the correct line/section			Service Environment	Area is hot and crowded
5) ENROLMENT REGISTRATION						
5.1 Queue in Registrar Section	The student take his/her turn in the queue in a fast and orderly manner	Queue is long and unorganized			Queue environment	Queuing area is hoi and uncomfortable
5.2 Hand in enrolment form and wait while student load are checked and enrolment is registered	Student load are accurately checked	The staff inaccurately checked the load	Student-staff	Staff is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Service Environment	Service area is hot and uncomfortable
	Registration status is completely updated	The staff failed to update the registration status in the system				
5.3 Receive feedback/advice	Successfully registered	The stuff inaccurately checked the load thus tell the student they cannot be registered	Student-staff	Staff is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Service Environment	Service area is hot and uncomfortable
5.4 Leave and transfer to next section	The assigned sections are easily spotted	Difficult to spot the correct line/section			Service Environment	Area is hoi and crowded
6) COR PRINTING						
6.1 Queue in ICT section	The student take his/her turn in the queue in a fast and orderly manner	Queue is long and unorganized			Queue environment	Queuing area is hot and uncomfortable
6.2 I land-in student ID to staff and wait while COR is printed	COR is primed successfully	Cannot prim COR	Student-staff	Staff is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty	Equipment and facilities	Computer and/or printer is broken or out of ink Enrolment system is offline or very slow
					Service Environment	Service area is hot and uncomfortable
6.3 Receive COR	Subjects and schedule in the COR are the same with the preferred ones	The subjects and schedule are different from the preferred ones as discussed with the chairman	Student-staff	Staff is impolite; inattentive; unfriendly; unapproachable; unkempt/dirty		

Table 3. Summary of potential failures

According to Functional Component	
1	The staff failed to update the registration status of the student in the system therefore the student cannot print COR and has to go back to registrar again to verify.
2	The amount of change given by cashier/staff is inaccurate.
3	It is difficult to spot the correct line/section in the one-stop enrolment area.
4	The queue is long and unorganized.
5	The receipt shows wrong amount.
6	No receipt is given.
7	The chairman mistakenly allowed the student to enroll subjects with prerequisites that are not yet complied thus resulting to invalidation (non-registration) of enrolment.
8	The chairman failed to enroll the student within the allowable number of units resulting to invalidation (non-registration) of enrolment.
9	The chairman inaccurately assessed the academic status of student as "not culled" and allowed to enroll even if not eligible to enroll; thus resulting to invalidation (non-registration) of enrolment.
10	The chairman inaccurately assessed the academic status as "culled" and prevent the student from enrolling even if student is eligible to enroll giving student unnecessary worry.
11	The enrolment form is inaccurately and incompletely filled out so student have to go back again to have it completed.
12	The registrar staff inaccurately checked the student load giving unnecessary worry to students.
13	The subjects and schedule reflected in the COR are different from the preferred ones as discussed with the chairman.
14	The subjects are not created in the system (transaction did not complete); hence student need to go back to the chairman to start the process again.
15	The assessment staff failed to update validation status of student so student has to go back again to verify.
According to Humanic Component	
16	The chairman/staff treats student impolitely (shouts or raise voice; demonstrate rough actions).
17	The chairman/staff is inattentive (performs other tasks not related to the transaction).
18	The chairman/staff is unfriendly and unapproachable (does not smile; keeps frowning).
19	The chairman/staff is unkempt and dirty.
According to Mechanic Component	
20	The queuing area / service area/ office area is hot and uncomfortable
21	The student cannot print because printer and computer is not working or out of ink
22	The enrolment system breaks down, thus preventing successfully registered student to print.

Table 4. Risk prioritization using customer-oriented FMEA

Failure Mode No.	Potential Failures	k	S	O	D	RPN _C = DOS ^k	Rank
16	The chairman/staff treats student impolitely (shouts or raises voice; demonstrates rough actions)	1	8	1	9	72	1
20	The queuing area / service area/ office area is hot and uncomfortable	1	5	1	5	25	2
8	The chairman failed to enroll the student within the allowable number of units resulting to invalidation (non-registration) of enrolment	0	8	2	6	12	3
2	The amount of change given by cashier/staff is inaccurate	-1	1	1	9	9	4
12	The registrar staff inaccurately checked the student load giving unnecessary worry to students	0	5	1	8	8	5
14	The subjects are not created in the system (transaction did not complete); hence student need to go back to the chairman to start the process again	0	7	1	8	8	5
19	The chairman/staff is unkempt and dirty	1	1	1	8	8	5
22	The enrolment system breaks down, thus preventing successfully registered student to print	-1	5	4	9	7.2	6
13	The subjects and schedule reflected in the COR are different from the preferred ones as discussed with the chairman	-1	5	5	7	7	7
7	The chairman mistakenly allowed the student to enroll subjects with prerequisites that are not yet complied thus resulting to invalidation (non-registration) of enrolment	0	7	1	6	6	8
15	The assessment staff failed to update validation status of student so student has to go back again to verify	-1	5	3	7	4.2	9
3	It is difficult to spot/find the correct line/section in the one-stop enrolment area	0	3	1	4	4	10
1	The registrar staff failed to update the registration status of the student in the system therefore the student cannot print COR and has to go back to registrar again to verify	-1	5	2	8	3.2	11
6	No receipt is given	-1	6	2	9	3	12
4	The queue is long and unorganized	-1	5	2	5	2	13
5	The receipt shows wrong amount	-1	5	2	5	2	13
21	The student cannot print because printer and computer is not working or out of ink	-1	6	1	9	1.5	14
10	The chairman inaccurately assessed the academic status of student "as culled" thus preventing student from enrolling even if student is eligible to enroll; hence giving student unnecessary worry	-1	6	1	7	1.17	15
17	The chairman/staff is inattentive (performs other tasks not related to the transaction)	-1	7	1	8	1.14	16
18	The chairman/staff is unfriendly and unapproachable (does not smile; keeps frowning)	-1	7	1	8	1.14	16
11	The enrolment form is inaccurately and incompletely filled out so student have to go back again to have it completed	-1	6	1	6	1	17
9	The chairman inaccurately assessed the academic status of student as "not culled" allowing students to enroll even if not eligible to enroll; thus resulting to invalidation (non-registration) of enrolment	-1	6	1	3	0.5	18

The top three critical failures according to RPNC were (1) impolite treatment of staff to students; (2) hot and uncomfortable environment; and (3) failure of chairman to enroll students within the allowable number of units. More than half (14) of the potential failures coming from all three service aspects had reverse attractive attributes. 5 potential failures, majority from functional aspect, had indifferent attributes. 3 potential failures from humanic and mechanic aspects had one dimensional attribute. This might suggest that students had high patience when it came to failures which were functional in nature. This might be contributed to the fact that the respondents were continuing students and had undergone the enrolment process several times already; thus, becomes tolerant of failure.

To provide appropriate recommendations for corrective actions and measures to be taken, potential cause(s) of failure

must be identified first. In addition, in this proposed framework, since the failures are already classified according to functional, humanic and mechanic aspects of the service, the corrective actions can also be recommended accordingly to such nature. For instance, if the failure is humanic in nature, recommendations can focus on corrective measures based on the humanic aspect. However, as the case may be, other recommendations not directly pertaining to what nature of the failure is can also be made, as necessary. Example, although the failure is humanic in nature, recommendatory measures based on the mechanic and functional aspects can also be considered depending on the possible causes that are identified. Table 5 illustrates this stage, using the top three critical failures as examples.

Table 5. Corrective actions

Rank	Potential Failures	Possible causes	Proposed corrective measures
1	The chairman/staff treats student impolitely (shouts or raises voice; demonstrates rough actions)	Non-knowledgeable e about good customer service aspects Environment triggers: noisy; crowded; hot Overworked / tired	Staff to undergo customer service training Provide a conducive working environment - pleasant both for staff and students to promote peace and calmness (apply appropriate mechanic clues to support humanic components in service) Provide support staff to assist or deload the work; or Minimize face-to-face enrolment transaction by making some of the processes online (example: student can load subjects online themselves; validation and registration status can be checked and updated online; student can receive SMS notification on registration status)
2	The queuing area / service area/ office area is hot and uncomfortable	Environment and facilities Service environment (even with comfortable facilities) cannot accommodate large number of crowd	Provide a conducive working/service environment - clean; cool and comfortable; provide chairs: fan or air conditioner Minimize face-to-face enrolment transaction by making some of the processes online (see example above*)
3	The chairman failed to enroll the student within the allowable number of units resulting to invalidation (non- registration) of enrolment	Human error No system support	Intensive staff training / orientation re academic rules Modify system to detect and notify transaction discrepancy such as overloading and under loading of units

A clear, systematic and easy approach of assessing service and identifying potential failures according to customer perspective by using customer journey and service clues has been presented. It is possible that without the aid of the two stages, some failures in the service may not be considered. If the enrolment flow would be the only basis to review the service, untrained evaluator or assessor may only identify failures according to the function of the service or according to the depicted major operational processes, which are academic loading, payment, assessment, registration, and COR printing. Human behavior and mechanic aspects of the service are typically not shown in a flowchart, and thus potential failures related to these aspects may be missed, such as the negative behaviors of staffs to students, and the hot and uncomfortable service environment. Latent needs and expectations of students are also not defined in the flow and thus may lead to unidentified potential failures related to these needs, such as inaccurate loading of desired subjects of students. Some activities of the students are also not shown in the process flow, such as queuing and transfer and arrival to the one-stop enrolment area, which could lead to non-identification of potential failures such as long and unorganized queue, and difficulty of

finding the correct section. Thus, the first two stages can facilitate assessment of service delivery and identification of potential failures that are important to customers.

The results also shows that in a service, the failure from functional component must not be the only concern of service providers, but also look into failures emanating from the actions of the employees as well as the kind of environment that is provided to customers.

To differentiate prioritization with and without customer perspective, the RPNs were also calculated using the traditional method. The results in Table 6 show that without considering customer perception, it resulted to different prioritization, with top three critical failures identified as system breakdown preventing successful printing of COR, subjects, and load are not the same as discussed with the chairman, and no receipt given. Most of these are the potential failures according to functional aspect. Further, based on the result of customer perception, they were the potential failures which had reverse attractive attribute (i.e., the failures that the students could accept when it happens). The critical failures identified with customer's voice moved down to rank 7, 14, and 5 respectively. This implies that the top priority in the view of the service provider may not be critical in the view of customers.

Table 6. Risk prioritization according to tradition RPN calculation

Failure Mode No.	Potential Failures	s	o	D	RPN = DOS	Rank
22	The enrolment system breaks down, thus preventing successfully registered student to print	5	4	9	180	1
13	The subjects and schedule reflected in the COR are different from the preferred ones as discussed with the chairman	5	5	7	175	2
6	No receipt is given	6	2	9	108	3
15	The assessment staff failed to update validation status of student so student has to go back again to verify	5	3	7	105	4
8	The chairman failed to enroll the student within the allowable number of units resulting to invalidation (non-registration) of enrolment	8	2	6	96	5
1	The registrar staff failed to update the registration status of the student in the system therefore the student cannot print COR and has to go back to registrar again to verify	5	2	8	80	6
16	The chairman/staff treats student impolitely (shouts or raises voice; demonstrates rough actions)	8	1	9	72	7
14	The subjects are not created in the system (transaction did not complete); hence student need to go back to the chairman to start the process again	7	1	8	56	8
17	The chairman/staff is inattentive (performs other tasks not related to the transaction)	7	1	8	56	8
18	The chairman/staff is unfriendly and unapproachable (does not smile; keeps frowning)	7	1	8	56	8
21	The student cannot print because printer and computer is not working or out of ink	6	1	9	54	9
4	The queue is long and unorganized	5	2	5	50	10
5	The receipt shows wrong amount	5	2	5	50	10
7	The chairman mistakenly allowed the student to enroll subjects with prerequisites that are not yet complied thus resulting to invalidation (non-registration) of enrolment	7	1	6	42	11
10	The chairman inaccurately assessed the academic status of student "as culled" thus preventing student from enrolling even if student is eligible to enroll; hence giving student unnecessary worry	6	1	7	42	11
12	The registrar staff inaccurately checked the student load giving unnecessary worry to students	5	1	8	40	12
11	The enrolment form is inaccurately and incompletely filled out so student have to go back again to have it completed	6	1	6	36	13
20	The queuing area / service area/ office area is hot and uncomfortable	3	1	5	25	14
9	The chairman inaccurately assessed the academic status of student as "not culled" allowing students to enroll even if not eligible to enroll; thus resulting to invalidation (nonregistration) of enrolment	6	1	3	18	15
3	It is difficult to spot/find the correct line/section in the one-stop enrolment area	3	1	4	12	16
2	The amount of change given by cashier/staff is inaccurate	i	1	9	9	17
19	The chairman/staff is unkempt and dirty	1	1	8	8	18

4. Conclusion

A customer-centric service failure prevention approach based on customer journey, service clues and customer-oriented FMEA has been presented in this paper with the aim to provide a holistic approach to service failure prevention by considering customer perspective, not only in the assessment and prioritization of failures, but also in an assessment of service and identification of potential failures. The customer journey, consisting of customer activities, expected outcomes, and touchpoints, has provided a better way of understanding service from the viewpoint of the customers. It does not only show the process that customers go through in the service but also it takes into consideration the needs of the customers, and the encounter they have with the service. This leads to a better assessment of the service according to how customers experience it. The service clues, which takes in the form of functional, humanic and mechanic, are perceived and experienced by customers in the service, and thus the performance of these clues becomes the basis of evaluation of customers of the service. The concept of service clues assists in the systematic identification of potential failures which may arise from its non-performance. Thus, potential failures are identified according to how customers assess the service, according to functional, humanic and mechanic aspects of the service. The assessment of failures and prioritization using the customer-oriented FMEA which takes into consideration the customer

perception to failure also pave a way to better prioritization that reflects the voice of customers.

The application of the proposed approach in an enrolment service process shows that customers give more importance to failures arising from humanic and mechanic aspects of the service than from functional aspects. Without using the proposed approach, some failures may not be identified, especially the failures from humanic and mechanic aspects because these are typically not shown in process flows. Moreover, process flows that are not mapped from customer perspective may fail to show some actions that are undertaken by customers and thus may result in non-identification of some failures related to it. In addition, prioritization of failures results differently, with and without a customer perspective.

With the service failure prevention framework developed, customers' perspective is taken into account, and thus failures that are important to customers are identified, assessed and prioritized led to proper recommendatory actions.

The proposed approach is still new and has its limitations. It only considers the journey of the customers during the service and does not consider the pre-service and post-service activities. Further studies involving these two may provide refinement to the approach. The effect on weights in RPN calculation can also be considered in further studies. It is also recommended that the approach will be applied to other types of service, other than what was illustrated.

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基于客户旅程线索的服务故障预防

關鍵詞

以客户为中心的服务故障
预防，
客户旅程
服务线索，
以客户为导向的 FMEA

摘要

客户及其对服务的看法被认为是服务失败的决定因素，因此，必须从客户的角度研究服务失败及其预防措施。本文提出了一个以客户为中心的服务故障预防框架，该框架旨在通过从客户的角度整合服务交付评估和故障分析来提供一种整体的服务故障预防方法，其中包括故障识别，故障评估和故障优先级作为纠正的基础。动作。使用客户旅程，服务线索和面向客户的FMEA来开发建议的框架。该方法已应用于注册过程，表明使用客户旅程有助于确定服务中的客户流程，需求，需求和接触点，并且与服务线索一起使用时，可以进一步促进系统有效地揭示对客户重要的潜在故障。从客户角度评估故障并确定优先级会导致更好的优先级，从而反映出客户的心声。案例研究表明，员工采取的行动会带来更高的风险，这进一步表明，服务失败不仅涉及服务的功能，而且与服务员工和环境的客户相遇也同样重要
