Technology-Induced Service Encounters Failures: A Taxonomy of Causes in the Hospitality Industry.

Abstract

The rapid technological advancements have profoundly reshaped service industries, particularly the hospitality sector. While offering numerous benefits, technology also introduces new complexities and risks, potentially leading to service failures and affecting customer satisfaction and organizational performance. Despite growing interest in this topic, an integrated and holistic understanding of root causes of technology-induced service encounter failure (TISEF) in hospitality remains lacking. This study addresses the gap by employing the Critical Incident Technique (CIT) with 215 Gen Z and millennial hoteliers to identify and categorize the underlying causes of TISEF. The resulting taxonomy offers a structured categorization that enhances hotelier's ability to develop more effective solutions—both through targeted employee training and more efficient service design, whether for prevention or recovery.

Key Words: *Technology-induced Service Failure, Frontline Staff, Well-being*

Track Example: *Technological Human-Centered Innovations*

Example: *Theoretical/Academic*

1. Introduction

The rapid advancement of technology has significantly transformed service industries, particularly the hospitality sector (Buhalis et al., 2019). Innovative technologies, such as artificial intelligence (AI), self-service kiosks, mobile applications, and robotic automation, have been widely adopted to improve operational efficiency, reduce costs, and enhance guest experiences. These technologies have revolutionized the contemporary service landscape, mediating most staff-to-customer interactions during a service encounter. However, while technology adoption presents substantial benefits, it also introduces new complexities and risks that can lead to service failures, negatively affecting customer satisfaction and organizational performance (Meuter et al., 2000).

The study of service failures has been a long-standing topic of interest in hospitality and service management research (Kim & So, 2023). Traditional service failure frameworks, such as the service recovery paradox (De Matos et al., 2007) and fairness theory, focus primarily on human error, customer expectations, and service recovery strategies. However, with the increasing presence of technology-induced service encounters (Makarem & Mudambi, 2009), these frameworks fail to capture the unique and complex causes underlying technology-induced service failure.

As technology becomes increasingly embedded in hospitality services, understanding the nature, causes, and consequences of technology-induced service failures during service encounters (TISEF) has become critical. A comprehensive understanding of TISEF is essential not only for designing effective service recovery strategies that address both technological and human factors but also for advancing theoretical development in the field. However, existing research often focuses narrowly on isolated incidents or specific failure scenarios, lacking a holistic and integrated perspective. To address this gap, it is necessary to clearly define technology-induced service failures and systematically identify their root causes within the hospitality context.

In response to this need, the present study develops a taxonomy of TISEF, providing a structured conceptual foundation to support future theory building, hypothesis testing, and model development. To achieve this, a critical incident analysis approach was adopted, as it enables the collection of rich, detailed accounts of real-world service failures. This method is particularly suited to exploring emerging and complex phenomena like TISEF.

Special attention is given to the younger generation of hospitality professionals, particularly Millennials and Generation Z, who not only form the majority of the current hospitality workforce but also represent a significant share of the global travel market. Their experiences are of particular interest because they

are widely regarded as tech-savvy, shaped by their upbringing in a digitally connected world (Cain et al., 2024; Femenia-Serra, Perles-Ribes, & Ivars-Baidal, 2019). Their deep familiarity with technology and strong preference for digital communication and information consumption make them especially valuable informants for understanding the evolving dynamics of technology-induced service failures in contemporary hospitality settings.

2. Literature Review

Service failure is commonly understood as the gap between customer expectations and the actual service performance delivered (Migacz et al., 2018). More specifically, Koc (2017) defines a service failure as "any type of error, mistake, deficiency, or problem that occurs during the provision of a service, causing a delay or hindrance in the satisfaction of customer needs" (p. 244). In the context of technology, technology-induced service failure during a service encounter refers to instances where frontline staff are unable to deliver satisfactory service due to a malfunction or breakdown of the technological systems involved. Such failures can trigger strong emotional reactions from customers—such as frustration, apprehension, and anger—and lead to switching behaviors, negative word-of-mouth, or even retaliatory actions (Kim & So, 2023).

Research on service failure and recovery in hospitality and tourism has evolved significantly over the past two decades. Koc (2019) provided a comprehensive review of service failure and recovery literature and called for more context-sensitive approaches that reflect the diversity of the hospitality and tourism industry. Expanding upon these foundational insights, Kim and So (2023) traced the evolution of service failure research, noting a shift from traditional service settings to more complex environments shaped by technological innovation.

As digital interfaces increasingly replace or supplement human interaction, technology-induced service failures have become a critical area of focus within service management research. Within this domain, self-service technology failures have attracted substantial scholarly attention. Dabholkar and Spaid (2012) found that failures in technology-based self-service systems evoke distinct attribution patterns among customers, particularly when human support is absent. Customers tend to process these failures differently, often experiencing higher dissatisfaction and stronger negative behavioral intentions when recovery is delayed or entirely automated. Similarly, Lee and Cranage (2018) discovered that customers assign less blame to organizations when failures in technology-based self-service systems are perceived as technology-driven rather than employee- or policy-driven, although such failures still significantly impact satisfaction levels.

Despite these important insights into attribution and satisfaction outcomes, gaps remain in the literature. A critical review by Shiwen, Kwon, and Ahn (2022) highlighted that most research on SST failures has primarily focused on technical aspects, while the emotional and relational consequences have been largely overlooked. They argued that while technical performance has been widely studied, the emotional processing of failures—how customers feel and cope after such incidents—remains underexplored. As self-service technology becomes more prevalent, understanding the emotional aftermath of failures is essential for developing effective recovery strategies.

Beyond self-service contexts, research has also explored how technological features might mitigate or exacerbate service failures. Fan et al. (2020) investigated technology anthropomorphism as a potential buffer against dissatisfaction. They found that human-like qualities attributed to technology can alleviate dissatisfaction after failures, but the effect is moderated by individual factors such as technology self-efficacy and interdependent self-construal. These findings suggest that recovery efforts must be carefully tailored to consumer profiles rather than adopting a one-size-fits-all approach. Newer technological environments, such as smart service systems, introduce additional complexities.

In summary, prior research has substantially enhanced our understanding of technology-induced service failures, particularly within the contexts of self-service technologies and smart service environments. Studies have provided valuable insights into areas such as customer attribution patterns, emotional

responses to service failures, and the moderating effects of individual consumer characteristics. However, the existing body of literature remains fragmented, with most research addressing isolated dimensions—such as technical performance, blame attribution, or emotional outcomes—rather than offering an integrated perspective on technology-induced service failures throughout the entire service encounter. Moreover, despite the increasing complexity and diversity of service technologies, no systematic typology has been developed to categorize and explain the different forms of technology-induced failures.

To address these gaps, the present study seeks to develop a holistic framework for understanding technology-induced service failures during service encounters. Specifically, this research aims to construct a typology that categorizes failures across multiple dimensions, thereby providing a more comprehensive foundation for future research and offering practical guidance for managing service failures in technology-driven environments.

Method

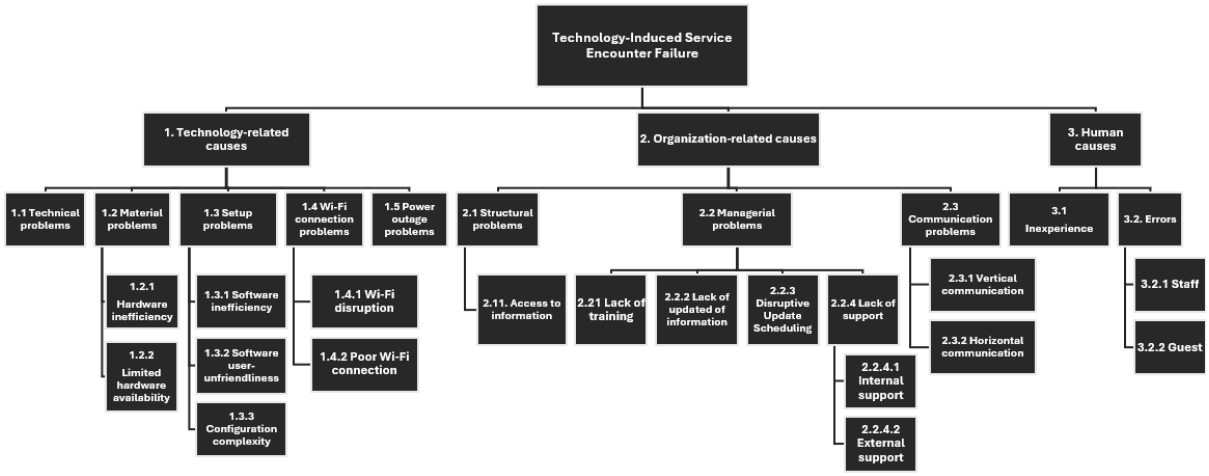
A data set of a sample of 215 persons was collected. The sample (age mean=24,76, 66% female, 34% male) consisted of hoteliers with one or two years of hospitality experience. Following previous CIT studies (Hoffman and Lee 2014), participants completed a paper-and-pencil questionnaire describing, in their own words, a TISEF incident. Structured follow-up questions were conducted to gather additional insights into the elements that negatively affected their experience, as well as the emotions that they experienced (Bitner et al., 1990). Data analysis followed Bitner et al. (1990) iterative coding and classification process. Four independent coders ensured the validity and reliability of the classification scheme. First, the taxonomy was inductively developed from the initial sample. Using an iterative clustering process, two researchers read, sorted, reread, and recombined the TISEF incidents until consensus was achieved on category labels and assignment of each TISEF to one of the resulting categories. Secondly, all TISEFs were then classified by a second team of two researchers who had not participated in the initial categorization tasks. Careful consideration was given to intra- and intercoder reliability (Gremler, 2004), with agreement rates over .89.

Findings

Taxonomy of TISEF Root Causes

In developing the taxonomy, *TISEFs'* root causes were classified based on the informants' description of incidents. Three main first-level categories emerged from the data. First, the incidents are caused by pure technology-related issues (1); Second, the causes related to organization and management (2); Third, the *TISEF* incidents are the consequences of human-related issues. The three categories are further divided into subcategories, as presented below. The distribution of *TISEF* incidents across categories and subcategories is illustrated in Figure 1.

Figure one: Taxonomy of Causes of Technology-induced Service Encounter Failure



Technology-related Causes

Technology-related causes refer to service failures arising from technological issues during service encounters. They can be categorized into five subtypes: technical problems (1.1), material problems (1.2), setup problems (1.3), Wi-Fi problems, (1.4), and power outage problems (1.5).

Technical problems (1.1) are issues frontline staff encounter due to technical dysfunction, such as software malfunctions or system crashes. Material problems (1.2) are issues directly related to hardware (e.g., machines, computers, iPads). This subcategory consists of two causes: hardware inefficiency (1.2.1) and limited hardware availability (1.2.2). Hardware inefficiency (1.2.1), such as slowness, outdated machines, overuse, and worn-out equipment, was identified as a trigger of *TISEF* incidents, hindering frontline staff from delivering a satisfying customer experience. Limited hardware availability (1.2.2) refers to the insufficient presence of technological equipment, resulting in restricted frontline staff access and reduced performance during service encounters. Setup problems (1.3) are issues related to software design. In some cases, respondents mention software inefficiency (e.g., slowness) (1.3.1) and user-unfriendliness (1.3.2) in software setup when describing the *TISEF* incident. In other cases, configuration complexity (1.3.3) arises from the integration of multiple systems. Wi-Fi connection problems (1.4) include Wi-Fi disruption (1.4.1) and poor Wi-Fi (1.5). As a frequently reported issue, Wi-Fi disruption (1.4.1) refers to incidents caused by lost wireless connectivity during service encounters. Poor Wi-Fi connection (1.4.2) involves weak or unstable wireless network signals in certain areas, often resulting in unstable and slow internet speeds and dropped connections. This issue is reported less frequently than Wi-Fi disruption, as it is often confined to specific areas and tends to have a more localized impact. Power outage problems (1.5) are TISEF *incidents caused by* complete or partial power failure, disrupting digital device use.

Organization-related Causes

This category refers to TISEF *incidents* arising from structural, managerial, and communication deficiencies within an organization. These failures are categorized into three subtypes: structural problems (2.1), managerial problems (2.2), and communication problems (2.3).

Respondents indicated that structural issues (2.1), such as a rigid managerial structure or inefficient workflow and service design, resulting in restricted access to information (2.1.1), could trigger TISEF incidents. This role and responsibility definition limitation may result from deliberate internal policies or unintentional oversight. The category of managerial problems (2.2) includes slack of training (2.2.1), lack of information updates (2.2.2), disruptive update scheduling (2.2.3), and lack of support (2.2.4).

These issues are more likely to stem from day-to-day operational and decision-making challenges. Despite the recognized importance of staff training among hotel management teams, high turnover rates and the frequent arrival of new team members may result in a lack of relevant training (2.2.1) in the use of software systems. This oversight contributes to TISEF incidents. Similarly, our data suggests that the TISEF incidents may also result from a lack of updated Information (2.2.2). The dynamic nature of hospitality demands frequent and rapid updates, further complicating synchronization among various internal digital tools. The multiplication of different systems often leads to outdated or inconsistent data. Disruptive update scheduling (2.2.3) refers to the management team implementing scheduled software updates at inopportune times, potentially disrupting service encounters. Based on our data analysis, the lack of support (2.2.4) is another frequent cause of TISEF incidents. In some cases, due to a hotel's internal service design, employees may encounter situations requiring assistance from the internal management team or colleagues (2.2.4.1). In other cases, the dependence on external agencies' assistance (2.2.4.2) may also cause TISEF. Communication problems (2.3) in TISEF incidents refer to deficiencies in information sharing, either between top management and frontline staff—vertical communication (2.3.1) or among peers —horizontal communication (2.3.2). In some cases, respondent reported that critical information shared from management was insufficient or poorly communicated, hindering their ability to use technology effectively and leading to service encounter failure. In others, communication failures at the peer level also lead to TISEF.

Human-related Causes

In addition to technological and organizational causes, our data indicates that human-related causes could also trigger TISEF incidents. These include staff inexperience (3.1.0), staff errors (3.2.1), and customer errors (3.2.2).

The IT systems used in the hospitality industry are complex and require both formal training and practical experience. As a result, staff inexperience (3.1.0) may hinder proper system use and lead to TISEF incidents. Data analysis also reveals that TISEF incidents may be caused by errors made by staff (3.2.1) or customer (3.2.2).

Discussion

Technology-related causes are macro-level and tend to be less stable and controllable, as they can occur unpredictably, are independent of human actions, and complicate resolution efforts. Technical problems account for the highest number of incidents reported by respondents. Frontline staff were surprised by the problem, unable to determine or understand the cause of the technological failure and frustrated by their inability to explain it to the customer during the service encounter, making the experience critical. Organization-related causes are meso-level issues with greater predictability, control, and stability, resulting from management decisions. Human-related causes are micro-level issues characterized by lower levels of predictability, control, and stability resulting from individual errors. The hospitality industry can be particularly challenging due to its complexity, fast pace, and dynamic nature. Achieving proficiency in this field often requires a long learning curve (Hinkin & Tracey, 2000).

Implications And Conclusion

Current research on TISEF remains fragmented, with most studies focusing narrowly on technical performance, blame attribution, or emotional outcomes. Furthermore, existing literature tends to group different TISEF causes either at project level or operational level, lacking an integrated and holistic —particularly within hospitality context. Thus, a systematic typology is needed to categorize and explain the various forms of TISEF. This study attempts to offer an overarching framework by developing a comprehensive taxonomy. By adopting a more holistic and integrative approach, this study offers a complete view of the root causes of TISEF, thereby providing a structured categorization that supports more effective solutions development for hoteliers —both in terms of targeted training and efficient service design, whether for prevention or recovery.

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Appendices

Code	***Direct quotes***
Technical problems (1.1)	*"The hotel where I did my operational internship was using Opera. Throughout my internship, we encountered problems with this system. Indeed, on numerous occasions, the system would disconnect from the payment terminals, or we could not use it at all" (Incident # 65).*
Hardware inefficiency (1.2.1)	*"It was frustrating because the iPad and materials we used were slow and often crushed during peak hours of guests' arrival" (Incident #83).*
Limited hardware availability (1.2.2)	*"We had a limited number of iPads, which was not enough to provide customers with the drinks menu at the same time as seating them. This slowed down the service considerably—not to mention the additional issues caused by battery problems. Management took a long time to respond, and we had to print paper menus for the drinks, but not in sufficient quantity. We constantly had to 'chase' after the menus or iPads, as customers did not want to spend hours waiting at the restaurant" (Incident #41).*
Software inefficiency (1.3.1) User-unfriendliness (1.3.2)	*"The system has numerous issues. The program is outdated and slow; it is not intuitive, and I often find myself struggling to complete even simple tasks, which ultimately take longer due to the lack of simplicity and user-friendly design. In practice, the system is often frustrating because of its slow performance. For example, during a call with a client, I must anticipate engaging in extra conversation just to fill the time while waiting for the system to load the desired page" (Incident #47).*
Configuration complexity (1.3.3)	*"I worked in the reservations department, where my daily tasks involved using Marsha (Marriott's reservation system) as well as Opera. We encountered many issues with these two systems. Sometimes, we didn't have access to Opera for several days— and vice versa. This became a major problem when the systems were down or no longer connected, as most of our reservations were made directly over the phone with us" (Incident #18).*
Wi-Fi disruption (1.4.1)	*"I worked as a receptionist in a luxury hotel in Paris, where I primarily used the Opera software, and all my tasks were carried out on a computer. The computer was connected to a private and secure Wi-Fi network, which helped prevent bugs, connection loss, hacking, etc. One day, at the start of a new work shift, the Wi-Fi suddenly stopped working—right in the middle of a check-in I was processing for a guest" (Incident #59).*
Poor Wi-Fi (1.4.2) connection	*"I worked in room service. I didn't use a tablet for ordering but only a telephone. Sometimes, the phones didn't have a network in certain parts of the hotel, so we couldn't receive the customer's call. Especially when we were in the lift sometimes it bellowed, and we could not hear the customer properly" (incident #190).*
Power outage problems (1.5)	*"Power cut, making it near impossible to work since we aren't used to working with paper anymore. It would take us nearly 40-50 minutes to check in each customer. After the power came back on, loading all the systems up was not something that we were qualified for, so we had to have the IT team come over to reconnect and reboot everything; in the process, some of our guest profiles were mismanaged and/ or deleted making it an overall frustration for both employees and our guests" (Incident #101).*

Access to information (2.1.1)	*"As receptionists and concierges, we did not have access to room management on Opera, making it difficult to obtain information about the rooms or other related details. When a guest requested information about the price of a room or other specific details, it was challenging to provide an immediate response. At such moments, frustration was certainly present" (Incident #52).*
Lack of training (2.2.1)	*"My work mainly consisted of serving dishes to customers, but during shifts when we were understaffed, my tasks often became more varied. Among other things, I had to take customer orders and enter them into the kitchen system using Micros. At first, I frequently made mistakes while inputting orders due to a lack of training (as this was not part of my initial responsibilities). On one occasion, I accidentally mixed up several orders between different tables, resulting in the wrong dishes being served to the wrong customers"(Incident #35).*
lack of updated of information (2.2.2)	*"On several occasions I was in charge of serving the drinks in the restaurant I worked in. Since my co-worker was in charge of taking the orders, I had no knowledge of what each table I served exactly ordered. I just blindly followed what was on the receipt/bill, which stated the order and what table. It was the mistake of our system that was not updated yet, so there were options still available to be ordered on the system, so my co-worker offered them to the guests but when it came to me preparing the drinks and then serving them I came to the realisation that the drink option no longer exists, as we do not have it in stock. I then was screamed at by the manager for being too slow and knowing how to execute a task when I asked her how I should deal with the problem since it involved going back to the client and apologizing to my co-worker for offering something that was no longer available" (Incident #114).*
Disruptive update scheduling (2.2.3)	*"Management had decided to update the MICROS AND OPERA system during a breakfast shift without informing us in advance. As a result, we had no access to customer data (name, room numbers, breakfast included or not). This made it impossible to identify customers and bill them for breakfast. This led to a lot of confusion and therefore a waste of energy and time not only for the staff but also for the customers. We were therefore angry with the management and stressed by the customers who simply wanted to have breakfast" (Incident #16).*
Lack of internal support (2.2.4.1)	*"With Opera, I sometimes found myself stuck when handling a specific customer request, which forced me to make them wait until my manager could assist me" (Incident #56).*
Lack of external support (2.2.4.2)	*"One day, during a busy lunch rush, with many customers to serve, we had to maintain a steady pace to ensure efficient service. Unfortunately, the software failed, leaving us unable to process payments or send orders electronically to the kitchen, as we normally would. As a result, service was delayed, and a queue quickly formed at the register…One of the most frustrating aspects was that we were unable to fix the problem ourselves. We had to contact the iKentoo support team before we could resume normal operations" (Incident #5).*
Vertical communication problems (2.3.1)	*"Management decided to update the MICROS and OPERA systems during a breakfast shift without informing us in advance. As a result, we had no access to customer data (name, room number, whether breakfast was included or not). Consequently, this made it*

	impossible to identify customers and process breakfast billing" (Incident #16).
Horizontal communication problems (2.3.2)	*"Communication between other departments and the F&B department was minimal, leading to numerous issues with breakfast reservations" (Incident #17).*
Staff inexperience (3.1.0)	*"At the beginning of my work experience, I felt colossal frustration using technology because I was not aware of the system very well before I work. Therefore, I was more concentrated on using technology without mistake instead of focusing on guest satisfaction. Moreover, using more than one technology in the workplace brought massive confusion to me. Personally, the use of different technology and learning at the same time negatively affects my work efficiency" (Incident #68).*
Staff errors (3.2.1)	*"During my internship in guest relations, one of my colleagues took a reservation over the phone for a client. This client requested a cake in the room upon arrival, along with balloons for his wife's birthday. Unfortunately, my colleague didn't note it in the correct section on the Opera system, and the cake order couldn't be placed with the pastry kitchen in time for the guest's arrival" (Incident #29).*
Customer errors (3.2.2)	*"One time, I worked in a restaurant, and the customer wanted to pay with his credit card. I have already taken the card device and entered the total: However, when tipping, the guest entered his pin code in the tip section and pressed OK, and a very high sum was charged. We could not transfer the money back to the guest until a week later, for technological reasons, which made the guest very angry. Without technology, this incident would not have happened" (Incident #147).*