CINEFORUM
ISSN: 0009-7039
Vol. 66. No. S1, 2026 (Special Issue 1)

Operational Challenges and Food Quality Maintenance in Railway Catering: Insights from Frontline Pantry Staff in India

[1]Vishal Prabhakar Gawande
Research Scholar, MMICT&BM (HM), Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, Haryana, India, ORC ID-0009-0006-0418-6596,
E- mail- vish005@gmail.com
[2]Dr. Rakesh Sharma
Associate Professor, MMICT&BM (HM), Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, Haryana, India, ORC ID-0000-0002-3762-1500,
E-mail- rakesh130188@gmail.com
[3]Dr. Ishan Bakshi
Associate Professor, MMICT&BM (HM), Maharishi Markandeshwar (Deemed to be University), Mullana, Ambala, Haryana, India, ORC ID-0000-003-4361-2915,
E-mail- ibakshi1988@gmail.com

Abstract
Maintaining food quality in mobile railway catering is challenging due to resource constraints, demanding service schedules, hygiene compliance requirements, and dynamic transit conditions. Limited study has been conducted on the operational challenges faced by frontline pantry workers, with most research centered on passenger perceptions. This study examines how limited resources, service time pressure, hygiene regulation issues and transit environmental stress affect food quality maintenance in railway catering operations. A quantitative survey was conducted among 150 pantry staff employed on long-distance trains operating under the Western Railway Zone of India. Operational challenges were ranked using Friedman test and the hypothesized relationships were studied using Partial Least Squares Structural Equation Modeling (PLS-SEM). The major operational constraint was resource limitations and service time pressure was the second major constraint. All four operational challenges were found to significantly and negatively impact on food quality maintenance, accounting for 58.5% of the variance in food quality maintenance. The results highlight the need for greater access to resources, better operational planning, better working environment and better hygiene management, to maintain good onboard food quality. This study is conducted from the front-line employee's point of view, and the railway catering and operations management literature is extended by empirical results on determining the factors affecting the operational maintenance of food quality, from the front-line employee's point of view.
Keywords: Railway Catering; Food quality maintenance; Operational Challenges; Resource Constraints; PLS-SEM; Frontline Employees.

1. Introduction

In the modern railway transportation system, foodservice quality is becoming a key factor of passenger experience and public health safety (Bujisic et al., 2014; Choudhury & Das, 2021). In the age of fast paced urbanization and the growing passenger numbers, the level of expectations for a safe and hygienic food service with timely delivery and nutritional quality

has risen several-fold across the globe. In this vast transportation landscape, onboard catering has evolved from a mere add-on luxury into a crucial service that significantly impacts passenger health, comfort, and confidence in national infrastructure (IRCTC, 2024; Ministry of Railways, 2024).

The scale of this operational challenge is nowhere more evident than in India. Indian Railways is the fourth largest railway network in the world with a record 741 crore passengers in FY 2025-26, an increase of 3.54% from FY 2024-25, and 25,000+ trains running every day (Ministry of Railways, 2026; PIB, 2026). In this hyper-scale, high-density environment, onboard catering requires managing complex supply chains that span vast geographical and climactic shifts.

Although the food service system has been subject to a number of systemic attempts at catering reform; food quality is continuously a critical problem, especially under the modern railway catering policies which have been adopted to unbundle the preparation and delivery of food and beverages, designated base kitchens. The Ministry of Railways' recent release of the Indian Railway Catering and Tourism Corporation (IRCTC) indicates that the organization received a massive 6,645 formal complaints from passengers in 2024–25 concerning the quality of food and beverages served in train kitchens (Economic Times, 2025). While the railway authority started actions, including fines in 1341 cases, warnings in 2995 cases and advisories in 1547 cases, the railway authority's reactive approach reflects a deeper systemic problem (ScanX News, 2025). These quality problems, despite the stringent regulatory sanctions, imply that basic operational constraints are present in food transport that make it difficult to maintain food quality.

Railway pantry operations are fundamentally different from conventional stationary foodservice operations, where the space and environment are extremely limited. The Standard Linke Hofmann Busch (LHB) pantry cars, which are ‘moving hot kitchens' are just 19,500 mm in overall length and have a highly restrictive utility space, with a limit of only 2,000 litres of water (IIT Kanpur SATHEE, 2023). In this small space, one person is responsible for supervising seven contractual caterers who have to prepare, store, heat, and service hundreds of meals at once as the vehicle runs at speeds of up to 160 km/h (IIT Kanpur SATHEE, 2023; Kumar, 2016). The pantry staff constantly struggles with physical instability, extremely tight service hours, variable passenger numbers, and limited access to raw materials and waste disposal processes (Mhlanga & Tichaawa, 2017; Seo et al., 2020).

Consequently, maintaining food quality is a complex, high-stress operational challenge. Food quality maintenance (FQM) is not a simple, static variable; it represents a continuous, multi-dimensional effort encompassing sensory properties (taste, appearance), microbiological safety, temperature control, and presentation consistency (Namkung & Jang, 2007; Ryu et al., 2012). Existing literature in the tourism and transport industry has confirmed that the perceived food quality in both sectors is the most important factor that influences customer satisfaction and intention to repurchase (Han & Hyun, 2017; Ryu & Han, 2010), however, this literature is based on a limited perspective of the passengers. It takes food quality as an end goal to be judged by the consumer and overlooks the operational reality and employee level challenges that ultimately will affect whether this end goal can be consistently accomplished.

In a service-intensive organization, service quality is intrinsically related to the way service providers execute their work (Bakker & Demerouti, 2018; Karatepe & Olugbade, 2017). In terms of railway pantry operations, these frontline realities can manifest as four major operational issues: Resource Constraints (including deficiencies in ingredients, water or specific storage), Service Time Pressure (due to delivery demands and staffing ratios), Hygiene Regulation Difficulties (including handling waste and maintaining hygiene in a mobile environment), and Transit Environmental Stress (due to continuous vibrations, noise and heat levels in the vehicles). The literature has addressed some of these aspects individually for the case of static catering and street vending (Ali et al., 2026; Soon et al., 2020), but the combined interactive effects of these dimensions on food quality in mobile food transport settings have never been studied.

This study addresses these gaps in the existing literature by establishing a robust, employee-centric conceptual framework. Grounded in the Job Demands–Resources (JD-R) Theory and Operations Management (OM) Theory, we investigate how the operational challenges faced by pantry staff shape food quality maintenance.

Research Objectives

In order to fill the identified gaps, this study will:

RO1: To rank the operational challenges experienced by railway pantry staff.

RO2: To examine the impact of resource constraints, service time pressure, hygiene regulation difficulties, and transit environmental stress on food quality maintained.

RO3: To evaluate the explanatory power of operational challenges in predicting Food quality maintenance in railway catering operations.

2. Theoretical Foundation and Hypothesis Development

2.1 Theoretical Foundation

To analyze the mechanisms through which operational challenges affect transit food services, this study integrates Job Demands–Resources (JD-R) Theory (Demerouti et al., 2001) and Operations Management (OM) Theory (Slack et al., 2022).

Under the JD-R framework, any work environment can be categorized into job demands and job resources. Job demands represent physical, psychological, social, or organizational aspects of the job that require sustained physical or mental effort, and are therefore associated with physiological and psychological costs. Job resources represent physical, psychological, social, or organizational aspects of the job that help achieve work goals, reduce job demands, or stimulate personal growth. If an organization's resources are inadequate for the demands of its operations, then employees will experience operational strain, which will result in a decrease in performance and service failures (Bakker & Demerouti, 2017).

The railway pantry on board the train is considered as a high demand and low resource setting. The four focus challenges: Resource Constraints (RC), Service Time Pressure (STP), Hygiene Regulation Difficulties (HRD) and Transit Environmental Stress (TES) are extreme and simultaneous pressures of any given job. Conversely, the main performance criteria are the ability of the pantry staff in keeping the food quality (FQM). A consistent quality of food is decreased if the demands of these operations exceed the coping resources of the staff and/or the food equipment on hand. In line with this perspective, the Operations Management Theory

(Slack et al., 2022) emphasizes the relevance of the service delivery outcome, allied with the process flow, spatial structure, capacity of the resources, and environmental stability. Any changes in the operations at the frontline translate to changes in quality of mobile transportation. From combining both perspectives, a hypothesis can be made that operational issues are structural stressors that can have a negative effect on maintaining food quality.

2.2 Conceptualizing Key Constructs

To ensure conceptual clarity, the operational definitions of the core constructs are provided in Table 1, adapted from hospitality management, food safety, and environmental ergonomics literature.

Table 1: Operational Definitions of Key Constructs

Construct	Code	Definition	Key Literature
Resource Constraints	RC	The perceived inadequacy of physical assets, storage equipment, raw ingredients, clean water, and power infrastructure required to prepare and preserve food on board.	Khan et al. (2021); Mensah & Dei Mensah (2018)
Service Time Pressure	STP	The sense of urgency and cognitive burden associated with having to prepare, feed, and deliver a multitude of meals in short station stops and hard set schedules.	Grobelna (2021); Karatepe & Olugbade (2017)
Hygiene Regulation Difficulties	HRD	The practical difficulties of implementing required hazard controls, sanitisation, raw to cooked food segregation and waste disposal in mobile and enclosed environments.	Ali et al. (2026); Soon et al. (2020)
Transit Environmental Stress	TES	Physical stressors involving the constant vibrations, high decibel noise, temperature changes and instability of the work space due to train movement at high speed.	Liu et al. (2022); Mhlanga & Tichaawa (2017)
Food Quality Maintained	FQM	Self-assessment by pantry staff about how well they can maintain the physical safety, temperature, sensory appeal, and cleanliness of food onboard.	Namkung & Jang (2007); Ryu et al. (2012)

2.3 Hypothesis Development

Resource availability is a fundamental prerequisite for successful operations (Slack et al., 2022). In stationary restaurants, resource supply is relatively continuous and predictable. However, in railway catering, replenishment is strictly tied to pre-scheduled stops at major station junctions (Kumar, 2016). Standard LHB pantry cars operate as closed ecosystems with fixed capacities, such as a 2,000-litre water tank and restricted cold-storage volumes (IIT Kanpur SATHEE, 2023).

Limited raw materials, up-to-date equipment, clean water, storage space, or other circumstances require adaptation of frontline staff. This frequently leads to compromising food preservation standards, for example, by shutting off refrigeration equipment to save energy, or by using water for cleaning (Khan et al., 2021). The JD-R approach suggests that severe resource limitations create a job demand which limits resource allocation resulting in a direct impact on food freshness and temperature management (Soon et al., 2020; Mensah & Dei Mensah, 2018).Therefore, we propose:

Hypothesis 1 (H1): Resource Constraints significantly and negatively influence Food Quality Maintained in railway pantry operations.

Railway catering is subject to meticulous and rigid timetabling of trains. Breakfast, lunch or dinner has to be delivered to hundreds of passengers at specific times within a specific time window (e.g., between the main stations). This puts pressure on the service at meal times (Grobelna, 2021).

Cognitive overload and fatigue occur when the service time pressure is above optimum levels. Based on the JD-R theory, employees are likely to seek shortcuts when they are under too much time pressure to focus on speed at the detriment of quality (Bakker & Demerouti, 2017). This pressure in transit food services can cause quality compromising behaviors in the food service including undercook food, not maintaining holding temperature, or not caring for appearance (Chiang et al., 2020; Karatepe & Olugbade, 2017). This leads to our second hypothesis:

Hypothesis 2 (H2): Service Time Pressure significantly and negatively influence Food Quality Maintained in railway pantry operations.

Adhering to strict food safety and hygiene protocols is essential to prevent foodborne illness and preserve quality (Soon et al., 2020). In mobile catering, implementing Hazard Analysis Critical Control Point (HACCP) principles is exceptionally difficult due to spatial congestion and restricted waste disposal options (Ali et al., 2026).

These problems are compounded by the absence of separate washing facilities, covered waste receptacles and pest control buffers in the older pantry cars (CAG, 2017). It is extremely challenging for frontline handlers to adhere to standard sanitary measures, which are essential to prevent cross-contamination, including regular handwashing and sanitizing surfaces (Odesanya, 2026; Garayoa et al., 2017). If staff can't fulfil the hygiene standards because of space and system limitations, the food safety and quality will inevitably be reduced. Thus, we hypothesize:

Hypothesis 3 (H3): Hygiene Regulation Difficulties significantly and negatively influence Food quality maintenance in railway pantry operations.

Transit Environmental Stresses (TES) are specific physical stresses of the mobile workplace that include constant vibration in the vehicles, high engine and cooking heat, physical instability and high noise (Mhlanga & Tichaawa, 2017).

Cooking utensils are affected by vibration and physical movements, thus compromising the cooking conditions and adding physical strain to the job for the pantry workers (Kundu et al., 2019). These factors can cause physical fatigue, difficulties in concentration, and impact work processes (Liu et al., 2022). This instability causes more opportunities for operating mistakes

(spills, wrong temperature, no temperature check etc.) which in turn impacts the food product quality. We therefore hypothesize:

Hypothesis 4 (H4): Transit Environmental Stress significantly and negatively influence Food quality maintenance in railway pantry operations.

3. Methodology

3.1 Research Design and Context

This study adopted a quantitative, survey-based research design to examine the operational challenges faced by railway pantry staff. The study was conducted in the Western Railway Zone of Indian Railways, with data collected across major railway divisions in Gujarat, including Ahmedabad, Vadodara, Rajkot, and Bhavnagar. This setting represents one of India's busiest railway networks and provides a suitable context for investigating operational challenges in onboard catering services.

3.2 Sample and Data Collection

The front line railway pantry staff such as head cooks, assistant cooks, pantry supervisors and service attendants was surveyed as a field study to gather the data. Purposive sampling approach (Etikan et al., 2016) was used due to the access to operational pantry cars needing official permission and the safety restrictions. The respondents were those who were currently working as onboard catering staff (IRCTC/authorized private contractors) for at least six months. The survey was carried out in the month of March to May 2026 at key railway stations in Gujarat on the trains while they are turning around and during the rest periods of the staff. Of the 170 questionnaires distributed, 150 valid responses were retained after screening for missing data and response bias, resulting in an effective response rate of 88.24%. Among the valid respondents, nearly half (49.3%) were aged 26–35 years, followed by 36–45 years (22.7%) and 18–25 years (21.3%), while only 6.7% were above 45 years. The major groups of workers in the sample were service attendants (58.0%), assistant cooks (19.3%), pantry supervisors (12.0%), and head cooks (10.7%). Most respondents had 1 to 5 years of work experience (56.0%) and 22.0% had 6 to 10 years of experience. In addition, most of the participants (82.0%) worked in IRCTC's licensed private catering contractors while 18.0% of the participants were departmental employees of IRCTC.

3.3 Measurement Instrument

In order to adapt all measurement scales to the railway catering context, they were taken from the validated literature. The questions were validated through expert review including three hospitality management academics and two senior IRCTC catering managers. Items in the instrument were rated using a 5-point likert scale (from Strongly Disagree to Strongly Agree). The Resource Constraints were adapted from Mensah and Dei Mensah (2018) and Khan & Qureshi (2021), Service Time Pressure from Karatepe and Olugbade (2017) and Grobelna (2021), Hygiene Regulation Difficulties from Soon et al. (2020) and Ali et al. (2026), Transit Environmental Stress from Mhlanga and Tichaawa (2017) and Liu et al. (2022), and Food Quality Maintenance from Namkung and Jang (2007) and Ryu and Han (2012).

3.4 Multi-Method Analytical Strategy inside SmartPLS 4

To address the research objectives, a two-stage analytical approach was employed using the primary dataset. To determine the ranking of the operational problems that railway pantry staff

face, the Friedman test was first performed. Second, the hypothesized links between operational challenges and food quality maintenance were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4 to develop a model. The measurement model was tested for indicator reliability, internal consistency reliability (Cronbach's α, Composite Reliability), convergent validity (AVE) and discriminant validity (HTMT). The structural model was then tested with the bootstrapping method, which was computed with 5000 resampled data sets, to estimate the path coefficients and test the statistical significance of the path.

4. Results and Data Analysis

4.1 Perceived Stressor Severity Ranking (Friedman Test)

Prior to estimating the structural paths, a Related-Samples Friedman's Two-Way Analysis of Variance by Ranks was executed on the four operational stressors as perceived by the pantry staff. The descriptive statistics for each stressor, alongside their corresponding Friedman Mean Ranks, are summarized in Table 2 .

Table 2 : Descriptive Statistics and Friedman Test Ranks

Operational Challenge	Mean	Standard Deviation	Friedman Mean Rank	Rank Position	Significance
Resource Constraints (RC)	3.7117	1.23285	2.72	1 (Most Severe)	Chi-Square: 8.403 Degrees of Freedom (df): 3 Asymptotic Significance (p-value): 0.038
Service Time Pressure (STP)	3.5250	1.33573	2.55	2	
Transit Environmental Stress (TES)	3.5750	1.07510	2.38	3	
Hygiene Regulation Difficulties (HRD)	3.4267	1.28509	2.36	4 (Least Severe)	

The asymptotic significance of 0.038 is below the standard threshold of 0.05, confirming that there are statistically significant differences in the perceived severity rankings of these operational challenges. Resource Constraints are viewed as the most significant constraint (Mean Rank = 2.72), followed by Service Time Pressure (Mean Rank = 2.55), and Transit Environmental Stress and Hygiene Regulation Difficulties are considered as moderate but still important daily operational stressors.

4.2 Measurement Model Assessment

The reflective measurement model was evaluated to ensure high internal consistency, indicator reliability, convergent validity, and the absence of indicator-level collinearity. As shown in Table 3, the measurement model exhibited satisfactory reliability and validity. All indicator loadings exceeded 0.70, Cronbach's α and composite reliability values were above 0.70, AVE

values surpassed the recommended threshold of 0.50, and all VIF values remained below 5.0, confirming adequate indicator reliability, internal consistency, convergent validity, and the absence of multicollinearity.

Table 3: Comprehensive Measurement Model Assessment

Construct	Item	Outer Loading	VIF	Cronbach's α	Composite Reliability (CR)	AVE
Resource Constraints (RC)	RC1	0.937	4.854	**0.949**	**0.963**	**0.867**
	RC2	0.937	4.472			
	RC3	0.923	3.862			
	RC4	0.928	4.400			
Service Time Pressure (STP)	STP1	0.931	4.326	**0.949**	**0.963**	**0.867**
	STP2	0.937	4.771			
	STP3	0.933	4.584			
	STP4	0.924	4.108			
Hygiene Regulation Difficulties (HRD)	HRD1	0.913	3.695	**0.940**	**0.957**	**0.846**
	HRD2	0.922	3.916			
	HRD3	0.918	3.493			
	HRD4	0.927	3.926			
Transit Environmental Stress (TES)	TES1	0.860	2.508	**0.894**	**0.926**	**0.759**
	TES2	0.868	2.317			
	TES3	0.856	2.231			
	TES4	0.900	2.930			
Food Quality Maintained (FQM)	FQM1	0.850	—	**0.832**	**0.888**	**0.665**
	FQM2	0.791	—			
	FQM3	0.787	—			
	FQM4	0.832	—			

Note: FQM serves as the endogenous target variable in our structural model; hence, indicator-level VIF values are not estimated for its reflective measures.

4.3 Discriminant Validity Assessment

To establish the empirical distinctiveness of our constructs, discriminant validity was assessed using the Heterotrait-Monotrait (HTMT) ratio. In exploratory and structural models, HTMT values should ideally be below the strict threshold of 0.85 (Henseler et al., 2015). The HTMT correlation matrix is presented in Table 4.

Table 4: Heterotrait-Monotrait Ratio (HTMT) Matrix

	FQM	HRD	RC	STP	TES
FQM	—				
HRD	0.656	—			
RC	0.750	0.638	—		
STP	0.731	0.627	0.773	—	
TES	0.611	0.361	0.441	0.481	—

4.4 Structural Model Evaluation and Hypothesis Testing

The measurement model was validated and then the structural model was evaluated. A complete bootstrapping method was used to estimate standardized path coefficients (beta), t-statistics, and p-values with a resampling size of 5000. The model is relatively strong with the R-square value of Food Quality Maintained (FQM) is 0.585 and the Adjusted R-square is 0.574. This means that the four operational challenges together explain 58.5 % of the variance in the food quality that was maintained by the frontline railway pantry staff.

The structural path analysis shows that the structural path from Resource Constraints to Food Quality Maintained is highly significant and has a negative sign (beta = -0.301, T-statistic = 3.222, p-value = 0.001), which is the strongest negative path and gives strong support to Hypothesis 1. Likewise, Service Time Pressure has a strong negative correlation with Food Quality Maintained (beta = -0.208, t-statistic = 2.057, p-value = 0.040) to support Hypothesis 2. Hypothesis 3 is also supported with this study, since the structural results show that the variable of “Hygiene Regulation Difficulties” has a significant and negative beta value of -0.194, T-statistic of 2.524 and p-value of 0.012 with the variable “Food Quality Maintained”. Finally, the negative impact of Transit Environmental Stress (beta = -0.251, t = 4.211, p-value = 0.000) is significant and has a large f-square effect size of 0.119, supporting Hypothesis 4. All four hypothesized operational demands are identified as critical structural stressors, directly threatening the ability to maintain transit foodservice quality, based on these results. The parameters of the complete structural model are summarized in Table 5.

Figure 1: Structural model for food quality maintained

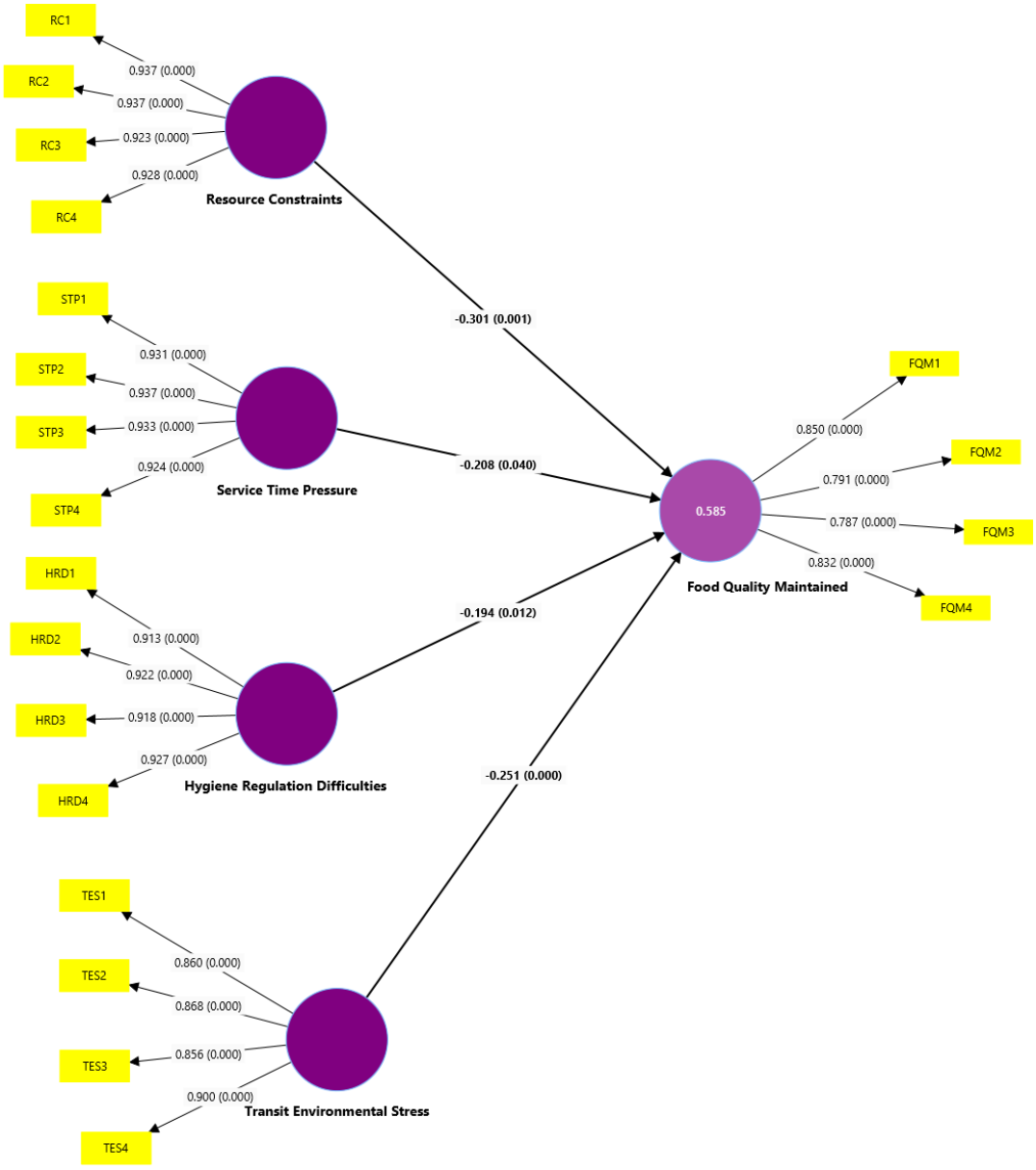

Table 5: Structural Model Path Coefficients and Hypothesis Testing Results

Hypothesis	Structural Path	Standardized Beta	T-Statistic	p-value	f-square	Effect Size	Decision
H1	Resource Constraints -> Food Quality	-0.301	3.222	0.001	0.090	Small-Med	**Supported**

H2	Service Time Pressure -> Food Quality	-0.208	2.057	0.040	0.042	Small	**Supported**
H3	Hygiene Reg. Difficulties -> Food Quality	-0.194	2.524	0.012	0.053	Small	**Supported**
H4	Transit Env. Stress -> Food Quality	-0.251	4.211	0.000	0.119	Medium	**Supported**

5. Discussion

The findings of this study contribute to the knowledge about food quality maintenance in railway catering as it shows that the service quality is affected by the front-line operational conditions. In line with the Job Demands–Resources (JD-R) model, all four work challenges negatively impacted food quality maintenance, suggesting that a lack of resources and challenging work conditions negatively affect an employee's ability to consistently provide safe and high-quality onboard food services (Bakker & Demerouti, 2017; Slack et al., 2022).

Resource constraints emerged as the most influential determinant of food quality maintenance, highlighting the importance of adequate water supply, storage facilities, refrigeration, and food handling infrastructure in mobile catering operations. Limited operational resources force employees to modify food preparation and preservation practices, increasing the likelihood of quality deterioration. This finding corroborates earlier evidence that resource inadequacies represent a major barrier to maintaining food quality in railway and institutional catering environments (Kumar, 2016; Soon et al., 2020; Garayoa et al., 2011).

A second strongest predictor was identified as transit, environmental stress, indicating that vibration, heat, noise and restricted working areas have a negative impact on physical work performance and working accuracy. These conditions contribute to fatigue and interfere with the normal food handling activities, which impacts on food quality. These findings have also been seen in other research related to environmental stressors and mobile food service businesses (Liu et al., 2022; Mhlanga & Tichaawa, 2017).

The service time pressure also played a significant role in the negative direction in food quality maintenance. The high passenger numbers and restricted train timings means pantry staff need to be flexible in achieving good standards of food preparation while keeping the service quick. This result aligns with previous hospitality studies that demonstrated that too much time pressure affects service quality and performance (Grobelna, 2021; Karatepe & Olugbade, 2017).

While the hygiene regulations problems were felt to be less severe, they were still an important determinant for food quality maintenance. The layout of pantry cars is limited which can also make it difficult to effectively provide for sanitation, waste management, and controlling cross-contamination, especially when trying to meet food safety standards. This result agrees with the findings of earlier studies which have shown the role of workspace constraints on hygienic practices in collective catering settings (Ali et al., 2026; Doğan & Tekiner, 2020; Palupi et al., 2024).

6. Implications

6.1 Theoretical Implications

The present research is an extension of the railway catering literature and the operations management literature to the foodservice environment on a moving platform. Combining the views from the JD-R perspective and the Operations Management perspective, the results showed that the resource constraints, service time pressure, hygiene regulation difficulties, and stress caused by transit environment are viewed as critical operational requirements that directly affect the maintenance of food quality. This study differs from earlier studies, which mostly focused on the passenger's food quality, by providing a foundational understanding of operational conditions at the front line as a key factor for service quality in railway catering (Bakker & Demerouti, 2017; Slack et al., 2022).

6.2 Practical and Managerial Implications

The findings provide clear operational priorities for railway authorities, IRCTC, and catering contractors. factors identified as having an impact on the quality of the food maintained onboard were the onboard infrastructure, greater water supply, refrigeration facilities, increased storage space, food handling equipment and uninterrupted utilities support. These deficiencies would permit the food safety and quality of the pantry when operating over large distances.

The impact of transit environmental stress is significant and suggests a need to enhance the environment of pantry cars. Improvements in ventilation, temperature control, workspace design, equipment stability and vibration control can help to decrease employee fatigue and operating mistakes, which can lead to more precise food preparation and food preservation.

For railway operators, it is important to allocate workers to shift, plan meal manufacturing and delivery plans in an optimal way, considering service efficiency and the quality requirements of food. Digital pre-ordering and better service planning can help further ease workload during peak service periods.

Despite being the least impactful of the challenges identified, hygiene regulation difficulties underlined the ongoing need for hygiene regulation. Frequent food safety training, standard operating procedures, periodic checks and audits and better waste disposal facilities would enhance hygiene compliance and minimize the risk of contamination. Taken as a whole, these results indicate that just using the service quality inspection to determine food quality will not be enough, and operational investments must be made that directly address the constraints experienced by frontline pantry staff for sustained improvements in food quality.

7. Limitations and Future Research

There are some limitations of this study. The cross-sectional study design precludes the examination of trends in operational challenges over time and the data may not be generalizable to other railway systems, due to the data collection based on staff from the Western Railway Zone. Also, the study is subjective and based on the perceptions of its employees, not on objective evaluations of food quality or microbiological safety. Longitudinal studies using several railway networks or transport systems, together with food safety perceptual measures as well as food safety objective measures, should be carried out in the future to better understand the management of food quality in mobile catering services

References

- Ali, A., Tahir, A., Ahmad, N., Trafialek, J., Alohali, B. M., Mohamed Ahmed, I. A., ... & Madilo, F. K. (2026). Food Safety in the Catering Sector: Nonconformities, Challenges, and Strategic Interventions With Insights From South Asia and Africa. *Food Science & Nutrition*, 14(1), e71400.
- AlKandari, D. S., Al-abdeen, J., & Sidhu, J. (2019). Food safety knowledge, attitudes and practices of food handlers in restaurants in Kuwait. *Food Control*, 96, 121-126.
- Bakker, A. B., & Demerouti, E. (2017). Multiple levels in job demands-resources theory: Implications for employee well-being and performance. *Handbook of Employee Engagement*, 43-58.
- Bakker, A. B., & Demerouti, E. (2018). Multiple levels in job demands-resources theory. *Industrial and Organizational Psychology*, 11(2), 299-303.
- Bujisic, M., Hutchinson, J., & Bilgihan, A. (2014). The effects of restaurant quality attributes on customer behavioral intentions. *International Journal of Hospitality Management*, 38, 78-91.
- Choudhury, T., & Das, S. (2021). Quality assessment of railway catering service: A study on passenger satisfaction. *Journal of Quality Assurance in Hospitality & Tourism*, 22(3), 305-325.
- Comptroller and Auditor General of India (CAG). (2017). *Report of the Comptroller and Auditor General of India on Union Government (Railways) - Catering Services in Indian Railways (Report No. 13 of 2017)*. Government of India.
- Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. (2001). The job demands-resources model of burnout. *Journal of Applied Psychology*, 86(3), 499-512.
- Disanto, C., Celano, G., Dambrosio, A., Quaglia, N., Bozzo, G., Tritto, A., & Celano, G. (2020). Food safety in collective catering: Knowledge, attitudes and correct application of GHP/GMP knowledge among foodservice workers. *Italian Journal of Food Safety*, 9(1), 8415.
- Doğan, M., & Tekiner, I. (2020). On-site and one-year monitoring of food service business risks associated with poor hygiene quality in the catering establishments for consumer protection. *Journal of Foodservice Business Research*, 23(4), 312-329.
- Economic Times. (2025). Onboard catering complaints rise: Parliament panel pulls up IRCTC. *The Economic Times*, New Delhi.
- Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1-4.
- Garayoa, R., Abundancia, C., Díez-Leturia, M., & Vitas, A. (2017). Essential tools for food safety surveillance in catering services: On-site inspections and control of high risk cross-contamination surfaces. *Food Control*, 75, 122-130.
- Garayoa, R., Vitas, A., Díez-Leturia, M., & García-Jalón, I. (2011). Food safety and the contract catering companies: Food handlers, facilities and HACCP evaluation. *Food Control*, 22(3), 519-525.

- Golovin, E. A. (2024). "Expand the range, improve the quality of service...": About the organization of trade and public catering on the Moscow-Kursk-Donbass railway in the late 1950s. *Proceedings of Southwest State University. Series: History and Law*, 14(1), 112-123.
- Grobelna, A. (2021). Service time pressure and frontline employee performance: The role of work engagement. *International Journal of Hospitality Management*, 94, 102830.
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2021). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2-24.
- Han, H., & Hyun, S. S. (2017). Impact of airport food court service quality on customer-perceived value, satisfaction, and loyalty. *Journal of Travel & Tourism Marketing*, 34(5), 654-668.
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1), 115-135.
- Indian Institute of Technology Kanpur (IIT Kanpur) SATHEE. (2023). *Engineering Layout and Thermal Comfort Evaluation of LHB Onboard Mobile Kitchens*. Research Report, IIT Kanpur.
- Indian Railway Catering and Tourism Corporation (IRCTC). (2024). *Annual Report 2023–24: Modernizing Rail Hospitality*. New Delhi: Ministry of Railways.
- Karatepe, O. M., & Olugbade, E. K. (2017). The effects of job demands, work engagement, and extra-role performance in the airline industry. *Journal of Air Transport Management*, 58, 20-31.
- Khan, N. L., & Qureshi, I. (2021). Impact of environmental concern on green purchase intention. *Asian Journal of Economics, Business and Accounting*, 21(3), 44-56.
- Kumar, D. A. A. (2016). Hospitality & Public Health-A Case Study of Indian Railway Catering and Tourism Corporation (IRCTC). *International Journal of Social Science and Economics Invention*, 2(10), 421-428.
- Kundu, S., Alam, S., & Salve, U. R. (2019, October). Development of a methodology for investigating thermal comfort and quality of air inside Indian railway pantry car. In *International Conference on Humanizing Work and Work Environment* (pp. 207-219). Springer, Cham.
- Labović, S., Joksimović, I., Galić, I., Knezevic, M., & Mimović, M. (2023). Food safety behaviours among food handlers in different food service establishments in Montenegro. *International Journal of Environmental Research and Public Health*, 20(4), 3120.
- Liu, Y., Zhang, J., & Cheng, L. (2022). Environmental stressors and performance of transit operators: The mediating role of physiological fatigue. *Transportation Research Part F: Traffic Psychology and Behaviour*, 88, 142-156.
- Lucas, A., Antalan, A. J. L., Ringor, K. M. C., De Guzman, J. P., Bautista, R. T., & Malinao, C. W. M. (2025). Assessing food handling practices in catering services across Isabela and Ifugao. *Journal of Management and Development Research*, 14(1), 45-56.

- Mensah, J. V., & Dei Mensah, R. (2018). Operational resources and service delivery in local governments. *Journal of Public Administration and Governance*, 8(2), 112-127.
- Mhlanga, O., & Tichaawa, T. M. (2017). Influence of operational challenges on service quality in mobile foodservice settings. *African Journal of Hospitality, Tourism and Leisure*, 6(4), 1-15.
- Ministry of Railways. (2024). *Annual Statistical Statements 2023–24*. Government of India, New Delhi.
- Ministry of Railways. (2026). *Indian Railways Year Book 2025–26*. Government of India, New Delhi.
- Namkung, Y., & Jang, S. (2007). Does food quality really matter in restaurants? Its impact on customer satisfaction and behavioral intentions. *Journal of Hospitality & Tourism Research*, 31(3), 387-410.
- Odesanya, J. (2026). Food service delivery, hygiene practice and passengers satisfaction at transport terminal: A case of Akure, Ondo, Nigeria. *Journal of Science, Technology and Innovation Research*, 11(1), 88-99.
- Palupi, I. R., Budiningsari, R. D., Khoirunnisa, F. A., & Hanifi, A. S. (2024). Food safety knowledge, hygiene practices among food handlers, and microbiological quality of animal side dishes in contract catering. *Italian Journal of Food Safety*, 13(1), 11020.
- Press Information Bureau (PIB). (2026). *Record Passenger and Freight Performance of Indian Railways in FY 2025–26*. Ministry of Railways, Government of India.
- Ryu, K., & Han, H. (2010). Influence of the quality of food, service, and physical environment on customer satisfaction and behavioral intentions in quick-casual restaurants. *Documents in Hospitality Management*, 29(3), 310-329.
- Ryu, K., Lee, H. R., & Kim, W. G. (2012). The influence of the quality of the physical environment, food, and service on restaurant image, customer perceived value, customer satisfaction, and behavioral intentions. *International Journal of Contemporary Hospitality Management*, 24(2), 200-223.
- ScanX News. (2025). Indian Railways issues over 4,000 warnings and fines to catering contractors. *ScanX News*, Transport and Logistics.
- Seo, S., Shin, J., & Kim, O. (2020). Operational determinants of performance in transit hospitality services: A study of train crews. *International Journal of Hospitality Management*, 89, 102550.
- Slack, N., Brandon-Jones, A., & Johnston, R. (2022). *Operations Management* (10th ed.). Pearson Education.
- Soon, J. M., Brazier, A. K., & Wallace, C. A. (2020). Food safety culture in collective catering: A systematic review. *Food Control*, 118, 107380.
- Wiatrowski, M., Rosiak, E., & Czarniecka-Skubina, E. (2023). Surface hygiene evaluation method in food trucks as an important factor in the assessment of microbiological risks in mobile gastronomy. *Foods*, 12(4), 812.