The Theory of Inventive Problem Solving (TRIZ) apply to innovative problem-solving in airline service quality

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Abstract

The purpose of this article is to delve into the realm of airline service quality, offering a conceptual idea that aims to provide airline industry managers with a holistic and comprehensive perspective. This article aspires to enhance the understanding and management of service quality within the airline industry. Throughout the article, these inventive principles are carefully elucidated and expounded upon in the context of the airline industry. They serve as a guide for managers seeking to revolutionize their approach to service quality, addressing various aspects such as customer experience, operational efficiency, and technological integration.

The Theory of Inventive Problem Solving (TRIZ) is a problem-solving method based on logic and data. It's corporate use across several parallel paths and increased in Six Sigma processes, project management and risk management systems and in organizational innovation initiatives which accelerate the ability to solve problems by methods of repeatability, predictability and reliability, and relies on the study of patterns of problems and solutions. The Theory of Inventive Problem Solving (TRIZ) study has proceeded in several stages and is composed of tools and techniques from across all disciplines and industries. In this article, the Theory of Inventive Problem Solving for "New Airline Service Design" research demonstrates the theory of inventive problem solving (TRIZ) proposed the new method applied to airline service sectors.

Keywords: airline industry, inventive problem solving, service quality

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Introduction

In the highly competitive airline industry, delivering exceptional service quality is paramount for customer satisfaction, loyalty, and overall business success (Parasuraman et al., 1988). To provide a holistic and comprehensive view for managers in the airline industry, a conceptual idea for an integrated airline service quality framework is proposed. This framework aims to align various aspects of service delivery, drawing inspiration from the 40 inventive principles of TRIZ (Theory of Inventive Problem Solving) adapted to the airline context. It encompasses both operational and experiential dimensions to enhance service quality throughout the customer journey.

The Theory of Inventive Problem Solving (TRIZ) is a methodology that aims to facilitate innovative problem-solving by identifying and leveraging existing solutions and principles across different domains (Arshad, S.S., 2019). While TRIZ was initially developed for engineering and technical fields, its principles can also be applied to non-technical areas like the airline service industry to foster creative problem-solving and drive improvement. TRIZ emphasizes using available resources efficiently. In airline service, this could involve finding innovative ways to utilize existing facilities, personnel, and technology to enhance customer experience without substantial investment.

TRIZ encourages breaking down a system into its core functions. For airlines, this could mean breaking down the journey into different service touchpoints, like booking, check-in, boarding, in-flight experience, and baggage handling (Park et al., 2021). Analyzing these functions independently can lead to creative improvements.

In the context of airline service, harmful effects might include passenger discomfort, long waiting times, or confusion during the travel process (Liou et al., 2020). TRIZ principles can help identify methods to eliminate or minimize these negative aspects (Zhang et al., 2019).

Objective

The objective of this article to purposed the conceptual idea to integrated airline service quality concept utilize theory of Inventive Problem Solving with the 40 inventive principles of TRIZ.

Background and Systematic approach of inventive problem solving (TRIZ)

The Theory of Inventive Problem Solving (TRIZ) is a problem-solving method based on logic and data. Genrich Altshuller developed TRIZ by analyzing more than three million patents and discovered the patterns that predict breakthrough solutions to problems. It's corporate use across several parallel paths and increased in Six Sigma processes, project management and risk management systems and in organizational innovation initiatives which accelerate the ability to solve problems by methods of repeatability, predictability and reliability, and relies on the study of patterns of problems and solutions (Chai et al., 2023). The TRIZ research has proceeded in several stages during the last 60 years and is composed of tools and techniques from across all disciplines and industries.

Theory of Inventive Problem Solving (TRIZ) in the service industry

A TRIZ viewpoint in the service industry, "A TRIZ-Based Method for New Service Design" research demonstrates the theory of inventive problem solving (TRIZ) proposed the new method applied to service sectors.

Theory of Inventive Problem Solving (TRIZ) applications in Airline Service Management

The research of TRIZ applications in the service sector has found that the most accessible and useful of TRIZ's 40 Inventive Principles in service operations is different from physical product development. The unique characteristics of the service industry, are for example customer participation, simultaneity, heterogeneity, intangible and perishable, which can determine the resolution of problems in the airline service (Wen et al., 2020). In order to achieve top service operations, interpretation of the 40 Inventive Principles of TRIZ and the innovative pattern applied to service development in airline operations is summarized according to table 1 below (Jeeradist et al., 2016).

The comparison of Service Management Solution and Airline Service Solution using TRIZ

The Theory of 40 Inventive Problem Solving (TRIZ)
TRIZ 1. Segmentation - Divide system into independent parts. - Increase the degree of segmentation.

Service Management Solution	- Divide service package into several components. - Segment service ranges into several categories.
Airline Service Solution	- Airline call center categorizes customers based on passenger needs.
TRIZ 2. Taking out Separate an interfering part or property from an object or system.	
Service Management Solution	Online reservation system (e.g., airline, hotel, cinema)
Airline Service Solution	To identify and eliminate redundant processes, leading to streamlined operations.
TRIZ 3. Local quality Change to non-uniform system suitable for the operations to fulfil a useful function	
Service Management Solution	Provide service offering based on customers' needs in various systems.
Airline Service Solution	By integrating sustainable practices in airline operations. Optimize fuel efficiency, reduce waste, and promote eco-friendly initiatives.
TRIZ 4. Asymmetry Change the system from systematic to asymmetric to increase degree of customer satisfaction and productivity.	
Service Management Solution	Service provides base on customer differentiation.
Airline Service Solution	Airline offers a common check-in for passengers at their preferred channel.
TRIZ 5. Consolidation or Merging Merging or bring system together, parallel operation.	
Service Management Solution	Building services and operating then together.
Airline Service Solution	A proposed Supplemental flight or Charter flight provided includes hotel accommodation and touring program together.
TRIZ 6. Universality Use standardized feature or make system perform multifunctionally.	
Service Management Solution	Service can be designed in a way to meet.

Airline Service Solution	Airline Equipment suitable for accommodating all passengers. Utilize advanced technology to personalize experiences, improving customer satisfaction.
TRIZ 7. Nest doll Place one object or system inside another or make one part pass through a cavity in the other.	
Service Management Solution	Good cooperation between back office and front-line office to maximize service performance.
Airline Service Solution	Extra in-flight entertainment and service for passenger satisfaction during flight.
TRIZ 8. Anti-weight - To compensate for the weight of a system and merge it with another system to provide the lift. - To compensate for the weight of a system, make it interact with the environment.	
Service Management Solution	Customers can become a communication medium for service firms who offer high services (e.g., word-of-mouth effect).
Airline Service Solution	Auditing or inspection of airline safety could help to educate passengers in the awareness of safety procedures in flight.
TRIZ 9. Preliminary anti-action - If it is necessary to perform an action with both harmful and useful effects, this action should be replaced with anti-actions to control any harmful effects. - Create beforehand stress in an object or system that will oppose known and undesirable working stress later on.	
Service Management Solution	- Before the commercialization of a new service product, preventive analysis should be done to identify any potential failure points in the service offering. - Software or hardware providers offer free technology support for customers through online enquiry, or by telephone.
Airline Service Solution	Airline could provide software support to customers through online enquiry or by telephone to inform passengers of safety procedure before flight.
TRIZ 10. Preliminary action - Perform, before it is needed, the required changes to an object or system. - Pre-arrange system that may be needed in action.	

Service Management Solution	The best training for customer contact personnel is needed before they begin to work for and represent company.
Airline Service Solution	The demonstration in case of an emergency in flight by flight attendants before the aircraft departure.
TRIZ 11. Cushion in advance or Beforehand cushioning Prepare emergency mean beforehand to compensate for the relatively low reliability of a system.	
Service Management Solution	To manage service capacity and smooth customer demand, service firm can use.
Airline Service Solution	Open access to passengers to share their experience and give advice to other passengers before travelling.
TRIZ 12. Equipotentiality In a potential field, limit position changes (e.g., change operating conditions to eliminate the need to raise or lower system in a gravity field).	
Service Management Solution	Provide a service network to enhance service performance and increase revenue.
Airline Service Solution	Alliance or code share in airline business model.
TRIZ 13. Do it in reverse or the other way round Invert the action(s) used to solve the problem.	
Service Management Solution	Deliver on-site service to customer resident.
Airline Service Solution	Turn a service or safety process upside down so that passengers can self-service instead of waiting in a queue to check in.
TRIZ 14. Spheroidality Go from linear rotary motion, use centrifugal forces.	
Service Management Solution	New service development from the feedback of customers and frontline staff.
Airline Service Solution	Passengers' feedback and information from frontline staff are valuable in airline development.
TRIZ 15. Dynamicity The moveable and adaptive process.	
Service Management Solution	Cross functioning of Member to improve service quality.

Airline Service Solution	Airlines increase flight schedule during high season to anticipate passenger demand and potential delays. Utilize AI and data analytics to optimize flight schedules and allocate resources effectively.
TRIZ 16. Partial or excessive actions If 100% of a system is hard to achieve using a given solution method then, by using 'slightly less' or 'slightly more' of the same method, the problem may be considerably easier to solve.	
Service Management Solution	Customer can be delighted if the perceived service quality exceeds their expectation.
Airline Service Solution	Giving notices beforehand and explanations to passengers for temporary unavailability of services in flight can prevent loss of customer loyalty due to 'blind' waiting.
TRIZ 17. Another dimension or Transition into new dimension Move system into two- or three- dimensional space.	
Service Management Solution	Differentiate and segment service to customers on the basis of their needs, behaviors, ages, etc.
Airline Service Solution	To separate class of service in the airline business based on passenger demand.
TRIZ 18. Mechanical vibration - Cause an object or system to oscillate or vibrate. - Increase its frequency	
Service Management Solution	Varying the required service capacity with the fluctuation pattern.
Airline Service Solution	To simulate various scenarios during crew training. Enhance their ability to handle diverse situations, improving onboard service quality.
TRIZ 19. Periodic action Pulsation action instead of continuous action.	
Service Management Solution	Adjust service capacity based on demand.
Airline Service Solution	Airline increases flights in high season and high demand.
TRIZ 20. Continuity of useful action - Carry on working continuously; make all parts of the system work at full load, all the time. - Eliminate all idle or intermittent actions of work.	

Service Management Solution	To provide continuous service delivery with non-stop.
Airline Service Solution	To forge strategic partnerships. Collaborate with hotels, transportation services, and other stakeholders to offer seamless travel experiences.
TRIZ 21. Skipping Conduct a process, or certain stage (e.g., destructible, harmful, or hazardous operations) at high speed.	
Service Management Solution	- Keeping customers waiting for a long time risks losing their loyalty. - An alternative way to manage waiting time is to let customers feel that the waiting time was skipped psychologically.
Airline Service Solution	Baggage delivery service of an airline is an extra service to passengers in order to reduce waiting time in the post flight process.
TRIZ 22. Convert harm into benefit or "Turn Lemons into Lemonade" - Use a harmful factor (particularly, harmful effects of the environment or surroundings) to achieve a position effect. - Eliminate the primary harmful action by adding it to another harmful action to resolve the problem.	
Service Management Solution	The service firm can improve its quality of service delivery by listening to customer complaints.
Airline Service Solution	In the airline, if service failure causes a flight delay, extra services such as providing hotel accommodation, serving complimentary meals or beverages can turn a potentially poor customer experience into a good one.
TRIZ 23. Feedback - Introduce feedback (referring back, cross-checking) to improve a process or action - If feedback is already used, change its magnitude or influence.	
Service Management Solution	- Instant feedback on sales and inventory movements can be obtain through the use of RFID tags. - Instead of waiting for customer feedback, some companies proactively use a computerized information system (e.g., bar coding or check out scanner technology) to collect and analyze customer buying behaviors.

Airline Service Solution	Airline 2D bar code and passenger tag may be developed to meet the real time feedback.
TRIZ 24. Mediator or 'Intermediary' - Use an intermediary carrier article or intermediary process. - Merge one object temporarily with another (which can be easily removed).	
Service Management Solution	Customers can be advertisers of service offerings (e.g., happy customer is willing to share with his friend the experience of good service).
Airline Service Solution	Airline crew and frontline staff are representatives of the airline service, i.e., the intermediaries between airlines and passengers. Their performances affect the airline's image directly.
TRIZ 25. Self-service - Make an object or system serve itself by performing auxiliary helpful functions - Use waste resources, energy, or substances.	
Service Management Solution	Customer participation in service delivery can be an interesting experience or even an attraction.
Airline Service Solution	To empower passengers during disruptions. Develop an AI-powered chatbot to provide real-time assistance and alternative solutions.
TRIZ 26. Copying - Instead of an unavailable, expensive, fragile object or system, use simple and inexpensive copies. - Replace an object or system or process with optical copies. - If visible optical copies are already used, move to infrared or ultraviolet copies. - Copy creative service concepts across different industries.	
Service Management Solution	The concept of the automatic vending machine has been copied and applied across different industries to provide a wide range of services such as returning library books, posting letters, and dispensing cash.
Airline Service Solution	Southwest Airline minimizes its turnaround time service process.
TRIZ 27. Dispose of Cheap short-living objects Replace an expensive object or system with multiple inexpensive objects or systems, compromising certain qualities (such as service life, for instance).	
Service Management Solution	Trial versions of software can often be downloaded for users to try out before making a decision to buy the complete version.

Airline Service Solution	Airlines may provide applications or software for passengers to demonstrate their convenience during flight and treating customer feedback as valuable insights. Rapidly integrate lessons learned to enhance services and prevent recurring issues.
TRIZ 28. Replacement of mechanical system or Mechanical substitution - Replace a mechanical means with a sensory (optical, acoustic, taste, or smell) means. - Use electric, magnetic, and electromagnetic fields to interact with the object or system. - Change from static to movable fields, from unstructured fields to those having structure. - Use fields in conjunction with field-activated particles.	
Service Management Solution	The development of e-services eliminates the necessity for physical travelling (e.g., videoconference, Web-based class, online order and payment).
Airline Service Solution	Electronic ticketing or boarding pass which airlines provide for passengers.
TRIZ 29. Pneumatics and hydraulics (Intangibility) Use intangible parts of an object or system instead of tangible parts.	
Service Management Solution	The brand images of service organizations can be a guarantee of service quality
Airline Service Solution	To guarantee airline service quality by the airline's image.
TRIZ 30. Flexible membranes or thin films - Use flexible shells and thin films instead of three-dimensional structures. - Isolate the object or system from the external environment using flexible shells and thin films**.**	
Service Management Solution	Service area may separate smoking and nonsmoking sections through flexible partitions and air-exhaust systems, depending on the demand.
Airline Service Solution	Service segmentation of the airline industry based on passenger demand.
TRIZ 31. Porous material - Make an object or system porous or add porous elements (inserts, coatings, etc.). - If an object or system is already porous, use the pores to introduce a useful substance or function.	
Service Management Solution	In order to enhance service quality, service providers can encourage and reward customers who feedback their experiences of consuming delivered service products.

Airline Service Solution	To create an environment conducive to relaxation. Introduce stress-relief amenities and services, enhancing passenger well-being.
TRIZ 32. Color changes - Change the color of an object or system or its external environment. - Change the transparency of an object or system or its external environment.	
Service Management Solution	Changing the color of a service facility might influence the customer's perception of the service.
Airline Service Solution	Cabin retrofit in the aircraft might influence the customer's perception of the service.
TRIZ 33. Homogeneity - Make objects or systems interactive with a given object or system of the same material (or material with identical properties).	
Service Management Solution	Some hospitals encourage patients who have recovered from illnesses to discuss their experiences with new patients to alleviate their preoperative fears about certain types of treatment.
Airline Service Solution	An open access of airlines for passengers to advise the details of their flight safety experience to other passengers.
TRIZ 34. Discarding and recovering - Make portions of an object or system that have fulfilled their functions go away (discard by dissolving, evaporating, etc.) or modify these directly during operation. - Conversely, restore consumable parts of an object or system directly in operation.	
Service Management Solution	Some of the elements in service packages will be consumed after they fulfil the assistance job to create the experiences in the minds.
Airline Service Solution	Airline invest in user-friendly apps and self-service kiosks, minimizing friction and enhancing the digital customer experience to eliminate paper-based processes.
TRIZ 35. Parameter changes - Change an objects or system's physical state. - Change the concentration or consistency. - Change the degree of flexibility. - Change the atmosphere to an optimal setting.	
Service Management Solution	The "focus" on service strategy rests on the premise that the service firm can serve its narrow target market more effectively and/or efficiently than other firms trying to serve a broad market.

Airline Service Solution	Providing special care and/or service by focusing on airline passenger segmentation.
TRIZ 36. Phase transitions Use phenomena occurring during phase transitions (e.g. volume changes, loss or absorption of heat, etc.).	
Service Management Solution	- As members grow older, some resort clubs may provide more family or retiree-oriented activities to cater for the evolution of members' needs. - Recreation centre's launch new leisure programs in different seasons.
Airline Service Solution	Special services provided to the elderly or young passengers travelling alone in the care of a special cabin attendant.
TRIZ 37. Thermal expansion (Strategic expansion) - Use thermal expansion (or contraction) of materials. - If thermal expansion is being used, use multiple materials with different coefficients of thermal expansion.	
Service Management Solution	Some service industries use an adaptable service capacity to cater for fluctuating demands of customers.
Airline Service Solution	Airlines increase frequency of their flights during high season.
TRIZ 38. Accelerated oxidation - Replace common air with oxygen-enriched air. - Replace enriched air with pure oxygen. - Expose air or oxygen to ionizing radiation. - Use ionized oxygen. - Replace ozonized (or ionized) oxygen with ozone.	
Service Management Solution	Contrary to the closed-system perspective that is taken in manufacturing, service operations adopt an open-system concept because of the presence of customers in the process of service delivery. This helps to enrich company's knowledge of its customers.
Airline Service Solution	Airlines can provide easily a 2-way communication process for passengers, such as Facebook, e-mail or other means for passengers' easy use to complain or give important information to the airline.
TRIZ 39. Inert atmosphere - Replace a normal environment with an inert one.	

- Add neutral parts or inert additives to an object or system.	
Service Management Solution	Use of neutral third parties during difficult negotiations.
Airline Service Solution	Providing a passenger service facility during the pre-flight phase of the airline industry.
TRIZ 40. Composite materials Change from uniform to composite (multiple) materials.	
Service Management Solution	- Adding tangible elements into service offerings can give customers physical reminders of their purchase of intangible services.
Airline Service Solution	- Airlines send souvenirs to passengers. - Airlines use multi-media to demonstrate in-flight safety.

(Adapted from:40 Inventive Principles with Applications in Service Operations Management)

According to the table above, the principle of TRIZ Inventive Principles have been proposed to developed in this article in order to applied and create a systematic approach to airline service management to serve both safety and service quality simultaneously. An analysis is in identifying the TRIZ inventive principle can be linked to improve the service quality. The service designed in TRIZ can be useful to improve airline service. For example,

1. **Integrated Service Ecosystem**:

Embrace an interconnected approach that unites various service touchpoints - from booking to post-travel support. Utilize TRIZ Principle #2 (Taking Out) to identify and eliminate redundant processes, leading to streamlined operations.

2. Customer-Centric Design:

Employ TRIZ Principle #6 (Universality) to create services that cater to diverse customer needs and preferences. Utilize advanced technology to personalize experiences, improving customer satisfaction.

3. Predictive Analytics for Demand and Delays:

Apply TRIZ Principle #15 (Dynamicity) to anticipate passenger demand and potential delays. Utilize AI and data analytics to optimize flight schedules and allocate resources effectively.

4. Continuous Learning from Feedback:

Implement TRIZ Principle #27 (Cheap Short-Living Objects) by treating customer feedback as valuable insights. Rapidly integrate lessons learned to enhance services and prevent recurring issues.

5. Seamless Digital Experience:

Utilize TRIZ Principle #34 (Discarding and Recovering) to eliminate paper-based processes. Invest in user-friendly apps and self-service kiosks, minimizing friction and enhancing the digital customer experience.

6. Adaptive Crew Training:

Apply TRIZ Principle #18 (Mechanical Vibration) to simulate various scenarios during crew training. Enhance their ability to handle diverse situations, improving onboard service quality.

7. Sustainable Practices:

Incorporate TRIZ Principle #3 (Local Quality) by integrating sustainable practices in airline operations. Optimize fuel efficiency, reduce waste, and promote eco-friendly initiatives.

8. Rapid Crisis Response:

Utilize *TRIZ Principle #25 (Self-Service)* to empower passengers during disruptions. Develop an AI-powered chatbot to provide real-time assistance and alternative solutions.

9. Collaborative Partnerships:

Apply TRIZ Principle #20 (Continuity of Useful Action) to forge strategic partnerships. Collaborate with hotels, transportation services, and other stakeholders to offer seamless travel experiences.

10. Emotional Well-being Services:

Utilize TRIZ Principle #31 (Porous Materials) to create an environment conducive to relaxation. Introduce stress-relief amenities and services, enhancing passenger well-being.

By integrating these TRIZ-inspired principles into the proposed framework, airline managers can approach service quality with a fresh perspective, focusing on innovation

and holistic enhancement. This approach ensures that the entire customer journey, from pre-booking to post-travel, is optimized for the highest levels of satisfaction, thereby establishing a competitive edge in the airline industry.

Discussion and Conclusion

In the airline industry, delivering exceptional service quality is essential to ensuring customer satisfaction, loyalty, and long-term success (Feng et.al, 2023). To provide managers with a holistic and comprehensive view of airline service quality, a framework integrating various dimensions can be developed. This framework should consider both traditional service components and emerging trends in the industry. Moreover, integrating Theory of Inventive Problem Solving (TRIZ) can enhance the framework's effectiveness in addressing challenges and generating innovative solutions (ICAO, 2014).

By integrating these dimensions into a holistic framework, airline managers can align their service quality initiatives with the 40 inventive principles of TRIZ. This approach fosters a culture of innovation, enabling the airline industry to overcome challenges, meet evolving customer expectations, and deliver exceptional service quality across all touchpoints (Chai, at al.,2023). The combination of a comprehensive service quality framework and TRIZ principles empowers airline managers to continuously improve and excel in a rapidly changing landscape.

By incorporating TRIZ principles, the airline industry can not only address existing challenges but also anticipate and solve future problems in a creative and systematic manner (CANSO, 2016). In the competitive landscape of the airline industry, providing exceptional service quality is essential for customer satisfaction, loyalty, and overall success (Liou at al.,2018). To guide managers in the airline industry towards achieving holistic service excellence, a comprehensive framework based on the principles of Total Quality Management (TQM) and incorporating the innovative strategies from TRIZ (Theory of Inventive Problem Solving) can be proposed (Zhang at al.,2019).

In conclusion, this article endeavors to contribute to the advancement of the airline industry's service quality landscape. By amalgamating established principles of service quality with the inventive brilliance of TRIZ, it offers a novel perspective that managers

can leverage to enhance their operations, foster customer loyalty, and steer their airlines towards sustainable success in an ever-evolving market.

Suggestion

TRIZ provides a systematic approach for generating innovative solutions to complex problems in the airline service industry. It guides teams to think outside the box and find novel ways to improve processes, services, and customer experiences.

Certainly, here are some specific benefits of using TRIZ (Theory of Inventive Problem Solving) in the context of airline services:

- Enhanced Customer Experience: Passengers will appreciate the personalized check-in process, reduced wait times, and improved communication.
- Operational Efficiency: Segmentation and dynamic adjustments minimize bottlenecks, leading to smoother operations and shorter queues.
- Technological Advancement: Integrating biometric technology showcases the airline's commitment to innovation and security.
- Continuous Improvement: Feedback collection allows the airline to identify pain points and innovate the check-in process iteratively.

By applying TRIZ principles to the airline service process, the airline can revolutionize its service quality, making the experience more customer-centric, efficient, and technologically advanced. This not only improves customer satisfaction but also enhances the overall image and competitiveness of the airline.

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