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THE INTEGRATION OF SAFETY AND SERVICE QUALITY MANAGEMENT TO IMPROVE AIRLINE SERVICE

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The purpose of this paper is to discuss and propose a conceptual framework of service quality management integrated with safety operations of airline business to achieve higher service quality while not compromising safety regulation. We expect the improvement of service quality in airline business that the management can monitor and manage the safety operation simultaneously. Safety Management System (SMS) in aviation industry and IATA Operational Safety Audit (IOSA) criterion, data concerned the relationships between service quality measurement (SQM) and safety operation procedure have been studied in order to propose the integration of a new conceptual framework to reach a high service quality of airline business. Both service quality and safety operations are the goal of airline business to improve the top service quality and high rank in the aviation industry. TRIZ (Theory of Inventive Problem Solving) research is a problem solving to integrate service quality and safety operation. This research would be enhanced the service quality of airline business in Asia while remain safety policies as standardization. Extend Safety Management System (SMS) and integrated service quality. In addition, airline industries are evaluated and provide service quality improvement plan by using TRIZ.

Keywords - Airline service quality, SERVQUAL, Safety Management System (SMS), IATA Operational Safety Audit (IOSA), TRIZ

1. Introduction

The open sky policy had implemented in the airline industry since 1987 (Chang and Chiu, 2009), consequent the deregulation for airline business in most part of the world affected the competition all over this industry (Oluwatoyin and Oluseun, 2008). Airline Business is a part in the aviation industry and classified as service industry. It has become one of the important business segments in the economic development of the countries, as a vital role of airline in moving passenger or goods from one

place to another, not only international route but domestic route are concerned, especially when the long distances and timeliness are involved (Archana and Subha, 2012). In the past decade, two major models of airline business were classified broadly according to their strategic model. The full service airline with a premium service is the traditional type and low cost airline is the other model that low price with minimum service is the strategy (Tiernan et al, 2008).

According to report from ICAO (International Civil Aviation Organization) in outlook for air transport to Year 2015, they expect increased per annum of international traffic at 5.1%, while expect increased per annum of domestic traffic at 3.1%. These increased can be divided to explain the growth of each region such as airline business of the Middle East are expected to growth in passenger traffic at 6.4% per annum, the Asia/Pacific growth at 6.1% per annum, the Europe, Latin America/Caribbean include African all of these regions are expected to growth in passenger traffic at 4% per annum which slightly below the world average, finally the airline business in North American region are expected to growth in passenger traffic at 2.8% per annum.

In the year of 2010, Boeing Company forecasted that the next over 20 years Asia Pacific will be become the largest world in aviation market, as it has one-third of the high air traffic volume. The emergence of ASEAN Economic Community (AEC) in 2015 which affected the service sector and airline business in Asia. The opportunity of airline business in Asia is tariff reductions policy which supported the free flow of goods and a service among these countries. The chance will be supported a good trend to the airlines in this region. The experience in severe challenges of airline business in the recent global recession and a highly competitive environment, the new business models in an airline business have been develop with experience of strong competitive among the rival (Fernando et al, 2011). In order to improve the service quality and retain the high rank in the aviation industries, airline companies should develop effective strategic plans which enable them the competitive against the rivals as well as to gain their leadership, revenue and profitability.

In connection with positioning airline brands, air carriers can be recognized the major strengths and weaknesses of their services (Wen and Chen, 2010). The strength competitive in the airline business caused airlines has to resorted difference strategy such as intensive marketing, advertising and promotion together with price and ticketing offering (Mustafa et al, 2005). The passenger satisfactions base on the ability of airline staffs to face and solved the problem immediately with the right decisions so the passengers don't have to wait too long when problem occurred and serve with the high standardization.

The downturn in airline business had occurred in the past decade with several adverse factors such as the fluctuation of fuel price which affected main costs in airline operations, the terrorism situation in September 11 or 9/11, the outbreak of SARS (Severe Acute Respiratory Syndrome) in 2004 and the Coronavirus disease (COVID-19) pandemic in late 2019 which affects different people in different ways is reshaping the aviation industry. This matter caused bankruptcy in many airlines. The regulatory safety requirement is the top priority and air safety record can be affected to airline image (Liou et al, 2008). While the high service quality is passenger expectation associated. Airline business has been able to consolidate the airline image by the method of integration which can be applied to managing passenger satisfaction improvement.

2. Literature Review

In order to focus in the service quality affected by safety operations of airline business, the aim in this part is to synthesize of related literature in service quality management in airline service quality then link together with safety operations criteria in airline business.

2.1 Service Quality Management (SQM)

In order to improve services quality, the numerous standards for Service Quality Management (SQM) have been applied in order to improve services quality performance in service industry. Serviceability performance depends on traffic ability performance and its influencing factors of resourcing and facility, dependability and transmission performance (ITU-T E.800). The explanation of customer evaluated, the term of service quality has been used by established with criteria or factors that consider when evaluating service quality (Chen et al. 2011). The definition of service quality defined by Gronross (1982) is the service quality level delivered to meet customer expectation. Lewis (1989), service quality definitions can be formulated from the customer perspectives and what customers perceive are important dimensions of quality.

According to SERVQUAL and SERVPERF in measuring service quality dimension, Parasuraman et al. (1988) developed a disconfirmation measurement called the GAP model. The SERVQUAL instrument used to measure service quality and its dimensions (Clem et al. 2008). The five dimensions are tangibles, reliability, responsiveness, assurance and empathy and 22 scales are containing in two parts. Gronroos (1982) and Parasuraman, Zeithmal and Berry (1988) were the pioneers in the conceptualization of the service quality construction, these authors maintained that the overall perception of quality was a disconfirmation of a customer's expectation and his/her evaluation of a service. In the last

decade, SERVQUAL instrument has been applied for measurement of perceived service quality, the research in measuring passenger experience in airline industry service had applied. On the other hand, Cronin and Taylor (1992) presented model called SERVPERF measured service performance from customer's perception only, the different from SERVQUAL which concerned both of customer expectation and customer's perception are concerned. Likert scaling is the method in scales ranking for each dimension (Aydin and Yildirim, 2012).

Gilbert and Wong (2002) revealed the study through the last decade from service quality research that there is a strong indication that improvement in service provides supported to increase profit and customer base through new and repeat purchase from more loyal customers. Hong Yen (2000) note that, due to the character of service unable to be produce in advance hence quality of service must exceed customers' expectations and the service quality's out come is also important. Customer satisfaction is the influence to loyalty. The growth and maximize profitability are primary stimulated of customer loyalty (Heskett et al, 1994).

2.2 Airline service quality and measurement

The service item defined by IATA (International Air Transportation Association) such as seat capacity for the reservation, ticketing, check-in process, in flight service, baggage handling, post flight at destination (Feng and Jeng, 2005). Since service quality is an important factor for airlines, several researchers have applied service quality related theories and methods in the airline industry. Most of the previous airline service studies have used the SERVQUAL Method to evaluate service quality (Park et al.2005). Huang (2009) revealed that SERVQUAL Method with quality dimensions have been applied to airline industry by many authors, such as three items of safety, timeliness and price are categorized by Gourdin (1988), items of food and beverage, timely, luggage transport, seat comfort, check in process and in flight service are categorized by Elliot and Roach (1993), items of luggage handling, cabin cleanliness, check-in process, flight transit convenience, timeliness and passenger complaints handling are consider in service quality dimensions by Haynes (1994).

The service quality in airline industry may be different from the other service industries (Feng and Jeng, 2005).Airlines need to understand passengers' need and expectations.According to airline business strategy, passenger satisfaction has become critically important (Archana and Subha, 2012).The understanding in competitive advantages on service quality by offer superior service an airline would lead in the market share (Cheng et al., 2011).In practice, most airlines measure passenger

perceptions of their service offering to understand the company's performance levels, without having clear knowledge of passenger expectations for service (Aydin and Yildirim, 2012). In order to meet passengers' expectations to improve service quality, the managers and staff should realize that improvement in service quality and service innovation would enhance passengers' repurchase intention and their recommendation to other passengers via a favorable airline company that they use. Thence the managers and staffs need to deliver all the promises they make to meet passengers' expectation, because passengers' basic expectation are related to the service that is promised to passengers.

As the mention of IATA (International Air Transport Association) concerned the airline industry service item such as reservation system, passenger ticketing, check-in system, in flight service, baggage handling and the post flight service on arrival at destination. The other view point from the passengers, airline's service quality such as frequency of flights schedule, flight safety procedure, catering program, comfort of seat and airline's on-time performance. The vision in service quality of airline operator is concerning in safety operations procedure, comfort in flight, hospitality and accuracy in service.

On the other hand, airline service measurement investigation method by the Analytic Hierarchy Process (AHP) with four criteria in service quality. The investigated to evaluate the service quality of 7 airlines such as China Airlines, Cathay Pacific Airways, China Southern Airlines, EVA Airways Corporation, Malaysia Airlines, Singapore Airlines and Thai airways International. The four criteria are as follow; 1) Tangibility: The measurement of physical service such as on board catering, comfort and cleanness of passenger cabin, onboard entertainment, onboard reading material. 2) Reliability: The measurement in safety procedure of cabin and accident rate of airline. 3) Responsiveness: The measurement of crews' courtesy and crews' responsiveness. 4) Assurance: The measurement of crews' efficiency and crews' language skill (Mustafa et al, 2005).

2.3 Airline safety strategy

2.3.1 IATA Operational Safety Audit (IOSA)

Safety operation in airline industry is the top priority. In the interest of continuous quality improvement, there for ISO 9001 has been approached to adopt the principles for ensuring the safety and service quality in airline business. The effective ISO standard which focuses through the sub-clauses the examples are sub-clauses 7.2.3 is Customer communications such as customer feedback, customer complaints, sub-clauses 8.2.1 is Customer satisfaction sub-clauses 8.2.2 Internal audit, sub-clauses 8.4

Analysis of data, sub-clauses 8.5.2 Corrective action and sub-clauses 8.5.3 Preventive action are still valid (Deb, 2007). Safety management and control system in airline industry named IOSA (IATA Operational Safety Audit) has been implemented to conduct the safety operations in airlines.

2.3.2 Safety Management System (SMS)

Safety Management System (SMS) has been introduced by The Federal Aviation Administration's Advisory Circular 120-92 to Airline operators. The key addresses in this circular aspect of ICAO (International Civil Aviation Organization) the initiatives of safety management in airline operations (Toney Jr. and Sandor-Scoma, 2008). SMS is a systematic, explicit and proactive businesslike approach to ensure the level of risk is acceptable, as low as reasonably practical and that there is continuing pressure to drive the level of risk down over time. The world's first SMS assessment standards for airlines are now included in the IOSA standards manual, thus providing the first global SMS benchmark. These standards have been validated to be in full compliance with ICAO standards. Safety Management System (SMS) may be an extension of existing systems, such as the quality management systems (CAA of NZ, 2012). ICAO (International Civil Aviation Organization) defined Safety Management System or SMS is a systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures (ICAO, 2006). Therefore, this paper aims to improved service quality on Safety Management System (SMS).

Table 1: Summary of Safety Operations and Service Quality Criteria in Airline Operations

Safety and Service Quality		Criteria	Measurement
Safety Operations	IATA Operational Safety Audit (IOSA)	<ul style="list-style-type: none"> - The quality assurance program - Continual improvement of all aspect of the IOSA program. - Administration of the IAR quality control process 	Safety Operations Index
	Safety Management System (SMS)	<ul style="list-style-type: none"> - Safety policy and accountabilities - Hazard identification - Safety investigation - Continual improvement of the SMS - International audit program - Management review - Safety training and education program - Communication of safety critical information 	Flight Safety Audit
Service Quality	5 Service Quality Dimension: - -Reliability	<ul style="list-style-type: none"> - Up to date aircraft and in-flight facility -Meal service such as items, test, freshness, quality, appearance,etc 	Customer Satisfaction Index (CSI)

Safety and Service Quality	Criteria	Measurement
<ul style="list-style-type: none"> -Assurance -Tangibles -Empathy -Responsiveness 	<ul style="list-style-type: none"> - Seat comfort - Seat space and leg room - In-flight entertainment service (books, newspaper, movies, magazines, etc) - Convenience of reservation and ticketing - Promptness and accuracy of reservation and ticketing - Frequent flyer program - On-time performance - Sincere interest in solving problem such as flight cancellation, baggage loss, etc - Safety record - Check-in service such as waiting time, efficiency, etc - Promptness and accuracy of baggage delivery - The amount imposed for overweight baggage - Providing seat that passenger prefer - Neat appearance of employee - Employee who are waiting to help passengers - Courtesy of employees - Employees who have the knowledge to answer passengers' questions - Give passenger personal attention - Convenience flight schedule - Non-stop flight 	

2.4 TRIZ for solving quality to safety contradiction

2.4.1 Background and Systematic approach of TRIZ

Theory of Inventive Problem Solving or acronym as TRIZ is a problem-solving method based on logic and data. This method was developed by Genrich Altshuller with more than three million patents have been analyzed to discover the patterns that predict breakthrough solutions to problems, it's spreading into corporate use across several parallel paths and increased in Six Sigma processes, project management and risk management systems and in organizational innovation initiatives which accelerates the ability in solving the problems by method of repeatability, predictability, reliability and relies on the study of patterns of problems and solutions (Slocum and Kermani, 2009). The research of TRIZ began with the hypothesis that there are universal principles of creativity that are the basis of creative innovations that advance technology. The research has proceeded in

several stages during the last sixty years. TRIZ is composed of tools and techniques from across all disciplines and industries.

2.4.2 TRIZ applications in service industry

In 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. The empirical study in case of developing of new service design provided to tourist in Singapore Sentosa Island and another is service operations at canteen of university (Chai et al, 2005).

2.4.3 TRIZ applications in airline service management

The research of TRIZ applications in service sector has found that the most accessible and useful of TRIZ Principles in service operations is difference from physical product development. The unique characteristics of service industry such as customer participation, simultaneity, heterogeneity, intangible and perishable which can be determine the resolution of problems in airline service operation. In order to achieve in top service operations, the interpretation of TRIZ principles well-applied to service development in airline operations as the summarization according to table 2.

The application of TRIZ Inventive Principles applied to airline service, the specific applied version some of these principles have to be created to suit the characteristic of airline services, the example in principle 1 of TRIZ named “**Segmentation**” this principle advice the dividing an object or system into independent parts such as service package in several components or make an object or system easy to disassemble by segmented customer based on their need, ages or behaviors. Principle 2 named “**Taking out**” by separated an interfering part from the service system and single out only necessary system such as an online reservation system in airline industry. Principle 7 named “**Nested doll**” by placing a system into another system such as entertainment system extra service or in flight duty free during long hall flight of an airline. Principle 8 “**Anti-weight**” means that the compensation for the weight of service system such as passenger can become a communication medium (word-of-mouth effect) of airline service which perform a high service quality. Principle 9 and Principle 10 are “**Preliminary anti-actions**” and “**Preliminary actions**” by take necessary action to control harmful effects with providing of technology software or hardware to support passenger through online enquiry. The pre-arrangement procedure of sufficient network system for passenger convenience with the purpose of “zero waiting time” to caused passengers safety and high service quality to meet passenger satisfaction.

In Principle 12 named **“Equipotentiality”** is such as possibility to issued e - boarding pass at home or anywhere by passengers themselves. Principle 13 is **“The other way round”** by turning a service or safety process upside down that’s passenger can self – service them instead waiting a checking queue in. Principle 14 **“Spheroidality”** is to perform a rotary motion and centrifugal force to develop the new service process such as passenger feedbacks and information from frontline staff are valuable in new service development. Principle 15 **“Dynamics”** is the adaptability of service capacity to meet passenger demand by airline increase the flight schedule or adjust aircraft capacity to meet passenger demands. Principle 16 **“Partial or excessive actions”** to prevent loss of passenger loyalty lost by advice to passenger for temporary unavailability of service in order. In other hand, customers can be delighted if the perceived exceeds their expectations. Principle 23 **“Feedback”** to keeping passenger record and feedback monitoring by technology support such as RFID or bar code, scanning. Principle 24 **“Mediator”** by use an intermediary carrier article or intermediary process such as passenger stay on the aircraft during flight. Principle 26 **“Copying”**, the emergency demonstration before aircraft take off by showing the movie instead of perform by cabin crew. Principle 37 **“Thermal expansion”** in airline, the supplementary flight traffic program during high seasonal. Principle 40 **“Composite material”** as an intangible in airline service thence souvenirs presented to passenger can be provide in additional (Zhang et al, 2009).

According to reviewing the literature we found that the model of New Solution for Service Improvement to achieve both safety operations and service quality was developed base on the airline safety and service quality play roll as the top priority and caused affect to passengers’ satisfaction also airline image, thence principle of TRIZ have been proposed to this research in order to applied and create a systematic approach to airline service management to serve both safety and service quality simultaneously (Jeeradist et al, 2016).

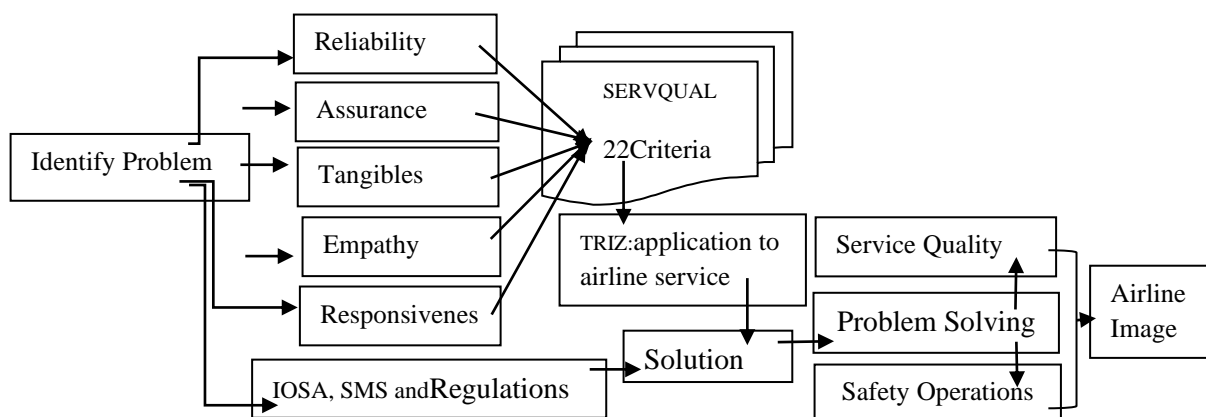


Figure1. The model of solution for analysis in airline safety and service quality contradiction by using TRIZ

3. Research Methodology

The methodology for collecting data and information in this research are including the literature review, internet search, library study and history case study. The qualitative study has been developed with the help of past literature on the five dimensions of the SERVQUAL model are take part in this study and direct or participatory observation to the population which consists of airline passengers who have had an experience with service in the airline industry. The related statistical information's had been searched in the public annual published of the authority concerned.

3.1 Analysis in airline safety and service quality contradiction

There are many factors that lead to airline image. Among these vital factors are service quality and safety operations of airline as these factors are the top priorities and may be affected passengers satisfaction. Hence this research frame work was developed base on the safety and service quality of airline operations. In the purpose to integrate airline service quality and safety operations thence the principle of TRIZ have been proposed to developed in this research in order to applied and create a systematic approach to airline service management to serve both safety and service quality simultaneously.

3.2 Empirical case study in airline safety and service quality

According to Jeeradist et al (2016), problem solving of airline service quality due to disruptive by technical problem of service equipment. Nowadays, the trend of developing the new products for aircraft interior has led various choice of airline to provide passengers seat style in concerned with passenger comfortable. The complexity in technical functions of electrical seat adjustment in various degrees and functional which provide in premium class or economy class is an airline image, but it may be the conflict in service quality if these equipment have the technical problem and unable to provide in full service as passenger expectation.

Identify Problem: In case of malfunction with the airline product such as passenger seat, it will be affected passenger dissatisfaction because of their perception in service. On the other hand, this will affect airline revenue caused of these unserviceable seats need to blocked and unoccupied by passenger. In airline operations, malfunction of aircraft equipment caused flight delayed for maintenance reason or wait for spare part changing. Not only the malfunction caused flight to be delayed but it may be caused flight to be cancelled also if the equipment unable to fix on time.

Problem Solving: An example case to identified and solved the problem is Singapore Airlines (SIA) choose the widest possible seats for its Airbus A380s, but it also ensured that the seats have the fewest possible parts, such as motors, cables, and switches, to keep the risk of malfunction and the cost of repairs low. This kind of thinking results in service excellence at a low cost. The service designed in TRIZ can be useful to improve this case of airline service as model below;

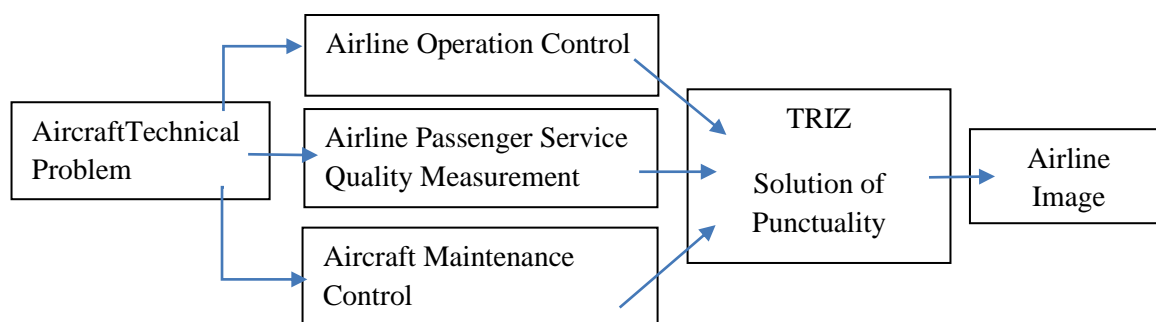


Figure 2. The Integration Operations process for analysis in airline safety and service quality due to technical problem of service equipment contradiction by using TRIZ

Table 2: TRIZ inventive principal link to improved airline service quality

TRIZ Inventive Principles	Airline Service Quality
<p>Principles 9. Prior counteraction: Create beforehand stress in an object or system that will oppose known undesirable working stress later on.</p>	<p>- Before the commercialization of a new service product, preventive analysis should be done to identify any potential failure points in the service offering.</p>
<p>Principles 16. Partial or excessive actions: If 100% of an 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.</p>	<p>- Giving beforehand notices and explanations to passenger for temporary unavailable of services in flight can prevent loss of customer loyalty due to blind waiting.</p>
<p>Principles 18. Mechanical vibration: Use combine ultrasonic and electronic field oscillations.</p>	<p>- Combine service functions in order to improved service quality of an airline business.</p>
<p>Principles 19. Periodic action: Use pauses between impulses to perform different action.</p>	<p>- In an airline operations, inspections of working conditions of equipments should be regular (periodic) to prevent accident breakdown.</p>

Solution Evaluation:

According to table 2, TRIZ Inventive Principle 9: Prior counteraction Create before and stress in an object or system that will oppose known undesirable working stress later on. Before the commercialization of a new service product, preventive analysis should be done to identify any potential failure points in the service offering. Principle 16: Partial or excessive actions, if 100% of a system is hard to achieve using a given solution method by using 'slightly less' or 'slightly more' of the same method, the problem may be considerably easier to solve. Airline should be giving beforehand notices and explanations to passenger for temporary unavailable of in-flight service that can prevent loss of customer loyalty due to blind waiting. Principle 18: Mechanical vibrations is combing ultrasonic and electronic field oscillations by combine service functions in order to improved service quality of an airline business. In Principle 19: Periodic action this method is use pauses between impulses to perform different action. In an airline operation, inspections of working conditions of equipments should be regular (periodic) to prevent accident breakdown.

4. Discussion

Because of safety is the priority in airline business thence airline have to consider and practice according to the FAA regulation, ICAO documentation and IATA policy also safety index which is the goal in airline operations. Many factors can be affected the airline's service goal such as aircraft characteristic, aircraft maintenance condition, flight operations of crews, air traffic control, weather condition, environment and also airline management strategy (Loui et al., 2007).

Base on case studies, we have found that both service quality perception and safety operation can be impacted to airline image. Thence using TRIZ principle for solving the conflict is a unique way of systematic thinking and improved in the integrated of airline safety and service quality management can be improved Airline Image (Chai et al., 2005). The understanding of TRIZ contradiction applied to airline business and the understanding of TRIZ to improve the contradiction in airline business is the path way to attend a top service quality of an airline business.

In order to investigated the complexity of the problem in these cases. We have conducted the research framework by identified the problem in each case with observed the procedure in airline operations. SERVQUAL and RATER model with 22 criteria have been applied as the guide line to survey the service quality of airline. On the other hand, the safety operation survey has been studied according to the FAA regulation, IOSA

(IATA Operation Safety Audit) criterion, SMS (Safety Management System) policy. The problem solving has been performed according to the problems which have been identified by using TRIZ Inventive principles application to airline service. Thence the solution evaluation will be resulted in the last process in the framework to reach the integrated of safety operations and service quality together to reach the airline image.

The research methodology was developed base on the empirical case study in the contradiction of safety and service quality. The case study in this paper is problem solving of airline service quality due to disruptive by technical problem of service equipment. According to problem identification we have found that passenger seat is one major problem in malfunction of aircraft equipment which cause of flight delay or cancellation due to maintenance reason. The problem solving by TRIZ principle 9, principle 16, principle 18 and principle 19 could be used to improve service quality and passenger satisfaction thence airline image could be approved.

5. Conclusion

The improvement of the safety and serviceability in an airline industry is extremely important in airline management. In summary, the objective of this research is to discuss and propose a conceptual framework of service quality management integrated with safety of airline business to achieve higher service quality while not compromising safety regulation. After discussing in three empirical cases study which affect the safety and service quality also airline image. The airline image conformance has relationship with the safety control and service quality of an airline. Understanding these relationships and applying TRIZ principles contradiction to integrate the safety and service quality enable an airline to improve airline image.

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