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TRIZ approach to innovate the collaborative decision making in aviation industry management

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ABSTRACT

To enhance and improve the impacts of service quality in aviation industry which effect customer perceptions, this paper focused and presented the case study to identify the factors that influenced service quality in aviation industry, and customer perceptions of aviation industry image. A literature review was on service quality measurement (SQM) and aviation industry analyses case study. The quality management framework SERVQUAL with five service quality dimensions including reliability, assurance, tangibility, empathy and responsiveness was used to assess customer requirements. Selected criteria from aviation industry services and TRIZ method approach with SERVQUAL measured customer satisfaction. Aviation industry service quality criteria were studied and TRIZ techniques were employed and integrate with the Collaborative Decision Making (CDM) model to innovate the improvement of service quality criteria.

Keywords: *TRIZ innovative, aviation industry, Collaborative Decision Making (CDM), Service Quality Measurement (SQM), SERVQUAL*

1. Introduction

Genrich Altshuller developed TRIZ by analysing more than three million patents and discovering that the patterns predicted breakthrough solutions to problems. TRIZ is now increasingly used in Six Sigma processes, project management, risk management and innovation initiatives. It solves problems by analysing their repeatability, predictability and

reliability by relying on the study of the patterns of problems and solutions [1]. A TRIZ perspective in service industries demonstrates that the TRIZ's 40 Inventive Principles in service operations differ from physical product development [2]. For example, unique service industry characteristics include customer participation, simultaneity, heterogeneity, intangibility and perishability which can help resolve aviation industry service problems. An empirical study on developing an innovative design was conducted with tourists on Singapore's Sentosa Island and a university canteen [3]. TRIZ principles have been applied to resolve contradictions between aviation industry service criteria and safety to improve customer expectations and perceptions and thereby improve aviation industry serviceability. This paper studied the interpretation of TRIZ's Inventive Principles applied to service developments in aviation industry operations. A proposed TRIZ for aviation services based on the in-depth case study is also presented.

According to Altshuller [4], TRIZ is positioned to be a powerful tool which is full of universal principles of invention which can be used as the basis for creative innovation. Service designers may potentially lack of ideas in generating new and fresh, yet innovative proposed improvement concepts. They are bounded to the previous experiences, or the limitation of service design tools. Thus, TRIZ (teoriya resheniya izobretatelskikh zadach, known as TIPS – Theory of Inventive Problem Solving), as the theory of the resolution of invention-related tasks, is proposed to overcome those limitations.

In order to solve the potential contradictions occurred due to two conflicting requirements to the same element in a system, the superiority of TRIZ methodology is one tool to solve these contradictions [5]. These potential contradictions must be identified and resolved. Thus, what will be proposed as improvement strategies can be deemed as a good compromise among any controllable and uncontrollable factors surrounding the identified problems.

2. Integrated TRIZ and SERVQUAL applications in aviation industry

2.1 TRIZ is a problem solving method

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 [6].

2.2 Aviation Industry service quality management using the SERVQUAL

SERVQUAL is a framework to measure service quality using the gap theory model. This has five service quality dimensions included reliability, assurance, tangibility, empathy and responsiveness, with 22 attributes that define service quality as the degree of discrepancy between customer expectation and customer perception of the service performance they received [7-9]. Previous airline service studies used the SERVQUAL method to evaluate service quality [10]

Service quality in the aviation industry is complex and differs from other industries. Aviation industry service quality includes service accuracy, safety procedures, punctuality of flight. The aviation industry service items are defined by IATA (International Air Transportation Association) and include all phases of flight such as preflight during on ground, in flight and at post-flight service [11].

2.3 Collaborative Decision Making (CDM) in Aviation Industry

Collaborative Decision Making (CDM) is primarily concerned with the effective operational processes of airlines, airports and air traffic control management. The purpose of CDM in the aviation industry is to improve airport operational standards and that has an impact on the airline Turnaround Process (TAP) during the preparation of the preflight phase. It also impacts on the aircraft takeoff phase and the approach for landing phase.

The aim of CDM is to improve air traffic flow and capacity management through taking effective steps to reduce aircraft taxi times and turnaround times which directly translate into economic benefits and improved environmental friendly conditions.

However, due to the diverse composition of the many actors on the stage, the assessment of overall turnaround performance relies on a CDM system that includes, inter alia, ground staff, airlines, the airport management and also air navigation service providers.

Since CDM is an important practical in aviation industry to be applied in airline, airport and air traffic service management. CDM key factor to enhance all participations such as airport slot coordinator will envision how many additional slots can be approved, airline operator will purpose how many flights can be applied with the schedule base on passenger demand and air traffic control unit can be developed the suitable technique to accommodate airport and runway capacity together with airspace surrounding with the air navigation services and runway capacity. At the same time, the aviation ground handling equipment unit will utilize their resources adequately and service however many additional aircrafts they can with few resources.

The principle of CDM is to put in place agreed cross-collaborative processes including communication protocols, training, procedures, tools, regular meetings and information sharing, which moves ATM operations from stovepipe decision-making into a collaborative management process that improves overall system performance and benefits the individual stakeholders [12].

CDM in Aviation is purposed to improve aviation operational efficiency such as reducing airport delays, improving the predictability of events during the progress of a flight and optimizing the utilization of resources [13]. According to R. Ghosh etal, one of factors is the aircraft which is the key connecting element between the aviation industry stakeholders such as airlines, airports, air navigation service providers (ANSPs) and manufacturers [14].

3. Purpose

The purpose of this paper is to discuss and propose a conceptual framework of Service Quality Measurement (SQM) integrated with TRIZ innovative process and Collaborative Decision Making (CDM) to enhance and improve the impacts of service quality in aviation industry which effect customer perceptions of aviation industry.

4. Methodology

The qualitative method and questionnaire were based on SERVQUAL's five dimensions and CDM, which sampling included airline operations, airport operations and ground handling, air Traffic Controller and air navigation service Provider (ANSP) with the staff concerned.

The method of focus groups and personal interviews were conducted, as well as direct or participatory observations of airline passengers and aviation industry employees. The questionnaire was developed following the steps shown in Figure 1 [15].

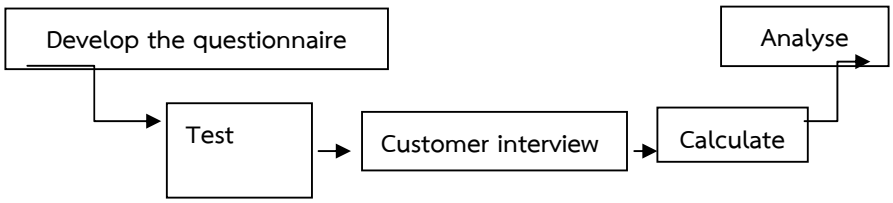

Figure 1. The questionnaire development process as adapted from Walden et al., 1993

The questionnaire was developed according to the process in Figure 1. Testing and revision of the collaborative decision making model was done by formulating questions on the service attributes for which feedback from airline passengers and aviation personnel. The questionnaire was constructed through criteria's of passenger and aviation personnel requirement questions.

To study service quality on the irregularity situation, the case study related to the problem of Air Traffic Congestion which affected aviation service quality. The problem was identified for solution. The collaborative decision making model integrated with TRIZ was considered in the case study if contradictions occurred when safety was the first priority for the aviation industry, but service quality did not reach customers' expectations.

Case study: Airline services may be disrupted due to air traffic congestion when sequencing take-off. Air traffic capacity en route also entails the necessity to hold aircraft on the ground awaiting take-off clearance from the Air Traffic Control Unit. When there are delays in flight schedules, passenger services are disrupted and connecting flights may be missed. Therefore, passenger satisfaction will be reduced and the airline reputation tarnished. Figure

2 shows the problem solving process for airline service quality challenges caused by air traffic congestion.

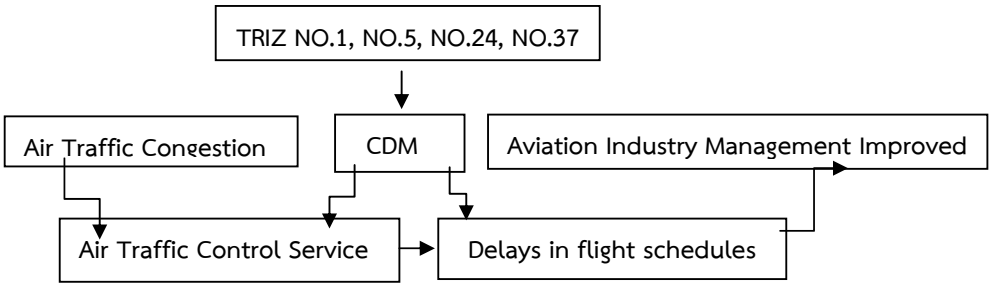

Figure 2. Using TRIZ in the Collaborative Decision Making (CDM) and service quality integration process for air traffic congestion

Identify and evaluate the problem: Flight delays caused by air traffic congestion both on the ground and en route can affect airline service quality. Congestion at the airport and in the airspace as it affected airline scheduling was studied. According to SERVQUAL and CDM model survey, Table 1 shows that technology combined with policy, and organising the concerned units by TRIZ solutions marginally increased functional capacities and improved airline scheduling.

Table 1. Customer requirement survey after air traffic using SERVQUAL and the Collaborative Decision Making (CDM) model

SERVQUAL RATER dimensions	CDM in Aviation Industry Service Criteria	CDM CODE
1. Responsiveness	Participant interest in solving flight delay problems	RCDM1
	Employees are willing to help in unexpected situations	RCDM2
	Courtesy of participant	RCDM3

SERVQUAL RATER dimensions	CDM in Aviation Industry Service Criteria	CDM CODE
2. Assurance	Flight safety operations	ACDM1
	Participant performed confident actions with customer tangibles	ACDM2
	Participant provided necessary information	ACDM3
	Staff have the knowledge to answer questions	ACDM4
	Staff willingness to help	ACDM5
	Staff promptly handle flight delays	ACDM6
3. Tangibility	Modernised equipment and tools	TCDM1
	Airport facilities	TCDM2
	Appearance of employees	TCDM3
	Quality of service	TCDM4
4. Empathy	Employees provide individual attention to the participant	ECDM1
	Alternative equipment and tools are available	ECDM2
	Cooperates are convenience	ECDM3
	Situation handling includes modern equipment and facilities	ECDM4
	Employees understand the participant's specific needs	ECDM5
	Employees provide speedy handling	ECDM6
5. Reliability	Flights are on-time	ReCDM1
	Participant performed accurate service during the case	ReCDM2
	Participant insistence on travel service	ReCDM3
Table developed from airline service quality measurement based on SERVQUAL and Kano's model [15]		

Problem solving using TRIZ method integrated with CDM criteria, the Air Traffic Flow Management (ATFM) programme was developed by the Global Navigation Satellite System (GNSS) to transform technology and improve problem resolution [17]. As shown in Table 2, the following TRIZ principles were used: #1: Segmenting service categories to improve service delivery efficiency, #5: Collaborating with the Air Traffic Service Unit to enhance service, #24: Improving Air Traffic Control by appointing a manager to communicate between the Air Traffic Control division and the work related to the aircraft and # 37: Increasing control sectors for Air Traffic Service during the high season to improve air traffic flow.

Table 2. TRIZ applied to improve airline service quality problems caused by Air Traffic Service

TRIZ Principle	Aviation Industry Service Quality Improvement
#1 Segmentation	Improve service delivery efficiency by segmenting into service categories
#5 Consolidation	Collaborate with the Air Traffic Service Unit to enhance services by transforming existing technology into new technologies or methods
#24 Mediator	Improve Air Traffic Control by appointing a manager to communicate between the Air Traffic Control division and the work related to the aircraft
#37 Thermal expansion	Increase control sectors for the Air Traffic Service Unit during the high season to improve air traffic flow and prevent flight delays

5. Conclusions, limitation and future researches

The aviation industry serviceability are conducted by FAA, ICAO and IATA regulations and policies. There are many factors that affect the aviation service such as aircraft characteristics and maintenance conditions, crew operations, air traffic control, weather conditions and airline management business strategies [18]. According to the case study, aviation service quality and safety contradictions may impact on the performance of industry. Using inventive TRIZ principles and CDM model to solve these conflicts provides a

unique way of systematic thinking, by improving aviation industry service quality management integration to innovate aviation industry improvement [19].

This research was conducted to identify service quality problems by interviewing passengers and employees, facilitating focus groups and observing airline operational procedures. The SERVQUAL dimensions integrated CDM model were used as guidelines to survey and measure the quality of aviation service. Problem solving was performed by applying TRIZ principle to aviation services. The evaluation resulted in a framework that integrated TRIZ and CDM model to improve with the innovative aviation industry services.

This research was based on the empirical case study of safety and service quality contradictions. Case study demonstrated an aviation industry service quality problem due to Air Traffic Congestion disruptions. Air traffic congestion, both on the ground at the airport and in the control zone or control area causes flight delays for scheduled departures and arrivals. Problem solving using TRIZ principles #1, #5, #24 and #37 was applied by integrated with CDM model linking technological policies and organisational solutions to increase air traffic volume capacity.

A limitation of the study was that only a case study was conducted. To overcome this limitation, further researches can utilize the proposed innovation model to solve other conflicts from other aviation service systems such as A-CDM (Airport Collaborative Decision Making), or Airline service, as well as to further validate the feasibility of the model from this study.

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References

[1] Gilbert, D., Wong, R.K.C., 2002. Passenger Expectations and Airlines Services: a Hong Kong Based Study. Elsevier.

[2] Zhang, J., Chai, K-H. and Tan, K-C. (2009). 40 Inventive Principles with Applications in Service Operations Management.

[3] Chai, K.-H., Zhang, J., Tan, K.-C., 2005. A TRIZ-base method for new service design. J. Serv. Res. 8 (1 August), 48e66.

[4] Arshad, S.S., 2009. Super stream approach to TRIZ planning, aviation safety. TRIZ J. (November)

[5] Chai, K.-H., Zhang, J., Tan, K.-C., 2005. A TRIZ-base method for new service design. J. Serv. Res. 8 (1 August), 48-66.

[6] ICAO, 2004. Outlook for Air Transport to the Year 2015. Circular 304 AT/127.

[7] Gronross, Christian, 1982. An applied service marketing theory. Eur. J. Mark. 16 (7), 30-41.

[8] Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. Journal of Retailing, 64, 12-40

[9] Wongrukmit, Thawesaengskulthai, 2014. Hospital service quality preferences among culture diversity. Total Quality Manag. Bus. Excell. 25 (7e8), 1e15.

[10] Park, J-W., Robertson, R. and Wu, C-L. (2005). Investigating the Effects of Airline Service Quality on Airline Image and Passengers' Future Behavioral Intentions: Findings from Australian international air passengers. The Journal of Tourism Studies Vol. 16 No.

[11] Feng, Cheng-Min, Jeng, Kung-Yeun, 2005. Analyzing airline service improvement strategy through importance and performance analysis. J. East. Asia Soc. Transp. Stud. 6, 782e797.

[12]. CANSO (2016). Civil Air Navigation Services Organisation

[13] Capgemini (2010), Collaborative Decision Making in Aviation. Capgemini's CDM Implementation. Center of Excellence Aviation

[14]. Lewis, Barbara R., 1993. Service quality measurement. Mark. Intell. Plan. 11 (4), 4-12

[15] Wen, C.-H., Chen, W.-Y., 2010. Airlines' competitive positioning using multiple correspondence cluster analysis. In: 12th WCTR, July 11-15.

[16] T. Jeeradist, N. Thawesaengskulthai, T. Sangsuwan, (2016) Using TRIZ to enhance passengers' perceptions of an airline's image through service quality and safety. Journal of Air Transport Management. 53 (2016) 131-139, Elsevier.

[17] Liou, J.J.H., Yen, L., Tzeng, G.-H., 2008. Building an effective safety management system for airlines. J. Air Transp. Manag. 14 (2008), 20e26.