

A study of the influence on the operational performance of Incheon International Airport by the implementation of a quality management system

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ABSTRACT

The purpose of this study is to determine the relationship between the implementation of a quality management system and the performance of Airport operations. It examined through the acquisition of an ISO 9001 certification, effect of process approach and operational performance of Incheon International Airport. As a result of continuous efforts with passenger and baggage quality management systems and process improvement activities, Incheon International Airport implemented a system to achieve the goals of shortening the arrival and departure processing times and minimizing the rate of mishandled baggage. The results of this study present performance data related to the implemented process and the improved performance achieved using the process approach. Therefore, this study provides evidence of superior airport operations and encourages airport operators worldwide to implement quality management systems. This paper provides valuable information and insights to help airport operations for achieve of competition advantage.

Keywords: Airport Operations, Competition Advantage, ISO9001, Process, Performance

1. INTRODUCTIONS

Airports Council International (ACI) is pleased to announce the recipients of its annual Airport Service Quality (ASQ) Awards for 2011. Speaking from the Trinity Conference in Seoul, South Korea on Incheon International Airport (IIA) named the Best Airport Worldwide for seven consecutive years, ACI World Director General Angela Gittens stated, "For Incheon International Airport to dominate in this category for seven consecutive years is testament to the degree to which customer service is intrinsically linked to their business strategy. What we are seeing across the globe is growing recognition among airport managers of the importance of quality customer service across the entire airport experience. In an era of increasing competition for passenger traffic, delivering consistent high levels of customer service can drive passenger loyalty and positively impact airport revenues. In increasing global competition among airports has highlighted the importance of service quality and ASQ is an ideal tool to help improve performance by facilitating the measurement, understanding of success factors and identification of problem areas." (ACI Media Release, 2012)

The Incheon International Airport has become the recipient of the ACI (Airport Council International) ASQ (Airport Service Quality) best airport award for 7 years in a row (ACI, 2012). Such excellence in the airport customer service is the outcome of continuous improvement efforts in its service processes through the certification of the International Organization for Standardization (ISO) 9001 based quality management system. The Incheon International Airport obtained ISO 9001 certification for its customer service processes by third party certification on November 15th, 2002 (LRQA, 2002).

Ebrahimpour (2007) empirically shows that the ISO 9000 based quality management system significantly improves the competitiveness and the profitability of a firm. For the successful implementation of such a quality management system, both internal and external processes must be analyzed. Thus, the operation of a firm can be defined by a set of business processes and the performance of a firm can thus be obtained by the total outputs from individual processes. This analysis serves complex processes like airport operations particularly well.

The importance of process oriented quality management is demonstrated by existing literature. Porter (1990) show that competitiveness is resulted from the effective and efficient deployment of the resources over the core processes. Ambatha and Momaya (2004) study the Asset-Process-Performance (APP) framework for corporate competitiveness. Kannan (2006) concludes that process excellence is a key for the corporate performance management.

In this study, we investigate the implementation process of the ISO 9001 based quality management system for the Incheon International Airport and show how the operational performance of the airport has continuously improved by standardizing the core customer processes of passenger arrival and departure.

In Section 2, a brief overview of ISO as well as the ISO 9000 standard process approach method is provided. In Section 3, the development of the 9001 based quality management system for the Incheon International Airport is investigated. In Section 4, the process operations in IIA, operations in the passenger arrival and departure processes, operations in baggage handling system is discussed. Section 5 includes discussions and implications. Finally, Section 6, conclusions, findings, theoretical and practical contributions and future research from results are summarized.

2. BACKGROUND

2.1. ISO Overview

The International Organization for Standardization (ISO) is a NGO (non-government organization) that links the national standards of 163 countries (each mandated by a member country or a national industry organization), and is the leading provider and authority to develop and manage International Standards. With its central office in Geneva, Switzerland, ISO accommodates needs from both public and private industry sectors (ISO website).

2.2. ISO 9000 Quality Management System Principle

The eight principles of quality management that form the basis of the ISO 9000 standards were the foundation for establishing the quality management system at Incheon International Airport to help to achieve the airport's vision and mission. In addition, the principles serve as a guide to improve the performance of the airport organization. The ISO 9001 standard provides a detailed description of the process approach for the eight principles (ISO 9001, 0.2 Process Approach).

2.3. Process Approach Method

ISO 9000:2000 clause 3.4.1 defines a "process" as "a set of interrelated or interacting activities which transforms inputs into outputs." The inputs and outputs can be either tangible or intangible. The ISO 9000:2000 standards recommend the process approach for the development, implementation, and improvement of the quality management system. The process approach is also reflected in the structure of ISO 9004:2000 ("Quality management systems – Guidelines for performance improvements") and ISO 9001:2000 ("Quality management systems – Requirements"). The process approach provides guidance on how the process interacts within a system and how to use the Plan-Do-Check-Act (PDCA) cycle when managing the process. One of the eight principles that form the basis of the ISO 9000:2000 family of standards addresses the process approach. The process approach is based on the notion that a desired result can be achieved more effectively and efficiently when a set of activities and related resources are managed as a process. First, ISO 9001:2000 requires the organization to identify and implement the processes necessary for the quality management system. Second, the organization is required to manage and continuously improve the process. Third, to achieve organizational goals, ISO 9001:2000 emphasizes the importance of managing the interacting activities between the processes. ISO 9004:2000 guides the organization to focus on performance improvements that exceed the requirements of ISO 9001:2000. In addition, ISO 9004:2000 recommends evaluating both the effectiveness and the efficiency of the process. Process effectiveness and efficiency can be assessed through internal or external review processes. The advantage of this type of approach is that the evaluation results can be documented, and the achievement of the improvement goals can be monitored. An examination of the PDCA Cycle and the process approach follows. The "Plan-Do-Check-Act" Cycle was first developed by Walter Shewhart in the 1920s and was generalized by William Edwards Deming. For this reason, the PDCA Cycle is sometimes referred to as the "Deming Cycle." The concept of PDCA is found in all professional disciplines, as well as in everyday life. In other words, the PDCA cycle is constantly being used formally or informally and consciously or unconsciously in all of our activities. Therefore, no matter how simple or complex, all process activities constitute the endless PDCA Cycle.

2.4. Previous Research

The existing studies on the implementation of the ISO 9001 based quality management system focus on the performance improvement obtained from the implementation. Naveh and Marcus (2005) provide empirical evidences to show that the implementation of the ISO 9000 standard significantly improves the operational performance, while not always lead to better business performance.

Jang and Lin (2008) empirically show that the corporate performance is greatly affected by the “depth” of ISO 9000 implementation. Furthermore, the implementation affects operational and market performances, to eventually influence business performance.

Nair and Prajogo (2009), based on the responses from 281 firms in service and manufacturing industries, show that functional factors such as customer needs as well as institutional factors such as internal operational performance improvement affect internationalization of ISO 9000 standards. In addition, such internationalization positively influences business performance. Dick et al. (2008) investigates the positive correlation of ISO 9001 implementation on the corporate performance improvement.

Previous research shows the absence of research on the effect of ISO 9000 implementation in the management context. Thus, in this study analyze the implementation of the ISO 9001 quality management system for the Incheon International Airport to investigate how the implementation contributes to excellence in customer service, most notably proved by the reception of the ASQ best airport service award for 7 consecutive years.

2.5. About the ASQ Awards

Since its creation in 2006, the ASQ Awards have become the world’s leading airport passenger satisfaction benchmark with over 220 airports participating. The ASQ Awards recognize and reward the best airports in the world based on ACI’s ASQ passenger satisfaction survey and represent an opportunity to celebrate the commitment of airports worldwide to continually improve the passenger experience (ACI Media Release, 2012).

3. DEVELOPMENT OF THE QUALITY MANAGEMENT SYSTEM FOR THE IIA

3.1. Airport Operations in the Incheon International Airport

Since its opening in March 29th, 2001, the Incheon International Airport has become one of the largest airports in the world (the 2nd largest in air cargo, the 8th largest in passenger traffic) with an overwhelming average annual growth rate of 6.3%. As a major hub airport in Asia Pacific (also “gate to Korea”), the Incheon International Airport is served by 79 airlines connecting 182 different international destinations all around the world. As indicated in Fig 1 (Appendix) illustrates the growth in passenger and cargo traffic since the opening of the airport. More importantly, the Incheon International Airport is widely recognized to be the best airport in customer service. The airport has won the prestigious ACI (Airport Council International) ASQ (Airport Service Quality) award for 7 consecutive years. In 2010, the airport was awarded "Best in Service Award in Class" at the 1st International Conference on Airport Quality and Service jointly organized by IATA (International Air Transport Association) and ACI.

In this study focus on the process approach method to analyze the implementation of the ISO 9001 based quality management system. This study also show the effectiveness of the implementation by investigating the two most critical performance measures: the average

processing times for passenger arrivals and departures and on-time baggage handling system performance.

3.2. ISO 9001 Quality Management Framework for Incheon International Airport

The ISO 9001 quality management system provides the means to establish an efficient and effective quality management system. ISO 9001 acts as an important guide for establishing a quality management system. The ISO 9001:2008 standard has a process-oriented structure that is based on the Plan-Do-Check-Act cycle and indicates a service or a product cycle, as well as a business management cycle. The key components of the requirements of the ISO 9001 quality management system largely consists of four types of core processes – management responsibility, resource management, service or product realization, measurement, analysis and improvement (ISO 9001, 2008). On November 15, 2002, Incheon International Airport obtained the ISO 9001 quality management system certification in all of the categories through a third-party certification from Lloyd's Register Quality Assurance (LRQA), which is a certification authority headquartered in the United Kingdom (LRQA, 2002).

Askey and Dale (1994) asserted that improvements in management control, service speed, productivity, and competitive advantage can be obtained with the ISO 9000 certification; they also stated that the ISO certification is provided as a framework for the successful implementation of a quality management system. In a study of 115 certified companies in Northern Ireland, Taylor (1995) claimed that the majority of CEOs showed an interest in moving into quality management from the ISO 9000. Weston (1995) reported that the majority of the 40 certified companies in Colorado obtained the ISO quality certification for quality management and continuous improvement. A study by Carr et al. (1997) analyzed the differences in business strategies, quality management systems, and performance reporting systems between the ISO-certified companies and the non-certified companies in New Zealand. In their results, these researchers argue that the ISO-certified companies are different from the non-certified companies because they value quality more than cost-efficiency.

Incheon International Airport obtained ISO 9001 certification by identifying the need for ISO 9000 certification through training and activities within the corporate organization that operates the airport and the outsourcing organization. As indicated Fig 2 (Appendix) the ISO 9001 quality management system certification process. First, the establishment of the ISO 9001 quality management system for Incheon International Airport applied the eight quality management principles of ISO for achieving the vision and mission that reflect the management team's philosophy and core values. The eight principles are customer focus, leadership, involvement of people, the process approach, the system approach to management, continual improvement, a factual approach to decision making, and mutually beneficial supplier relationships. Second, the quality policy, the corporate regulations, and the customer service charter were enacted, and the subsequent major performance standards were set and promulgated. Third, the KPI (Key Performance Index) was developed, which can reflect the operational quality standard goals, corporate efforts, and performance to establish the enterprise-wide management goals. Fourth, within ISO 9001, the enterprise-wide management goals were set as the annual objectives for each center, considering the budget, and the objectives were allocated to the infrastructure to be implemented by the corporate and outsourcing organizations. Fifth, the assessment and measurement of customer demand and satisfaction were classified into external evaluation and internal evaluation approaches, where the external evaluation consisted of a public enterprise management assessment, a head of organization management assessment, and ASQ (Airport Service Quality) monitoring, while

the internal evaluation consisted of service satisfaction and concession satisfaction. Furthermore, with respect to the management goals and the process improvement activities for the entire enterprise, as well as for outsourcing partners in the airport's operation, this system was established to evaluate the appropriateness and the implementation of the ISO 9001 quality management system standards (management responsibility, resource management, service realization, measurement, analysis, and improvement) through quality audits and to provide feedback. This system established the airport operation framework by applying the ISO 9001 quality management system based on processes. As indicated in Fig 3(Appendix) a concept for the establishment of the Incheon International Airport quality management system based on ISO 9001.

3.3. A Process-Based Airport Operation Quality System

An airport is a physical location where air traffic switches to ground traffic, and the airport constitutes the most important part of the air traffic system. Thus, an airport is a space where the four main elements that constitute the air traffic system (i.e., airport, air route control, airlines, and airport users) closely interact with each other. An airport functions as a way station or final destination in air travels. Expressed in functional terms, an airport facility must be designed to allow aircraft takeoffs and landings. In terms of these two operations, the loading and unloading of passengers and cargo must be possible, and the necessary operations must be provided. As a result, an airport operation is divided into the movement area and the management area. After the approach, the aircraft uses the runway, the taxiway, and the parking area to the apron, which is its final destination. At the apron, the loading and unloading of the passengers and the cargo occurs. The payload proceeds from the apron to the access system through the terminal, and the departing passengers move to the departure gate through the operation of the management area. The passenger and cargo terminals at airports themselves are facilities that provide the following three features. First, these terminals manage traffic congestion by providing a physical connection between the aviation equipment and the ground equipment; this physical connection is designed to be appropriate for the nature of the equipment operations in the movement area and the management area. Second, the terminals provide the facilities necessary for the boarding, documentation and control of passengers and cargo. Third, the terminals allow for changes in the pattern of movement in which ground transportation is used to regroup and reclassify the passengers and cargo according to the pre-planned flight schedules and the size of the departing aircraft.

The arriving passengers and cargo have a reverse flow. Airports require an operating organization that can handle diversity and complexity. An airport is composed of complex and heterogeneous organizations, such as the airline operations, including the handling of passengers, aircraft services, maintenance, technical support, the flight crew, the cabin crew, and the ground crew; airport information; commercial activities that are necessary for the economic stability of the airport, including leases and rents; airline support facilities; air traffic control; weather; and government functions, including plant and animal quarantine, customs, immigration control, policing and security. As indicated in Fig. 4 (Appendix) an airport operation quality system based on interrelated processes for a diverse and complex airport. As shown in Fig. 4, a complex interaction is bound to occur between the diverse and heterogeneous operating organizations in a process-based airport operations system. Inefficient operations and operational failures within a large airport operations quality system can cause massive losses, including additional personnel costs for the organization, wasted time for the passengers, and costs from delayed cargos. Therefore, to direct and control the heterogeneous and complex interrelated organizations, it is essential that the related operating organizations be provided with an ISO 9001 quality management system that is effective and

can improve efficiency.

4. RESULTS

4.1. Process Performance Improvement in Incheon International Airport

The Incheon International Airport focused on improving the efficiency (i.e., maximizing the productivity) when it was first opened. After the airport operation is stabilized, the key processes are reexamined from the customer service perspective. More specifically, the passenger arrival and departure processes as well as the baggage handling process are investigated. In order to improve the operations performance of the passenger arrival and departure processes, the process is simplified and reorganized for the convenience of travellers: self-check-in kiosks and KISS (Korea Immigration Smart Service), similar to the Global Entry program for US and the NEXUS between US and Canada, are deployed to save queuing time at check-in counters and immigration, respectively. This result in significant reduction in queuing time (more than 5 minutes) and more than 3.2 million passengers, in 2010 alone, have enjoyed the services. Also, the number of immigration officers has increased from 40 to 52. Together with efficient manpower planning, this increase contributes to shorten queuing time at immigration far beyond the ICAO standard.

4.2. Performance Improvement in the Passenger Arrival and Departure Processes

The processing time for the passenger departure process is, as defined by ICAO, measured from the moment when customers arrive in check-in counters to the moment when the customers arrive in their departure gates. ICAO recommends the processing time to be within 45 minutes in 95% cases and the maximum processing time should not exceed 60 minutes (except for the passengers required for additional screenings/examinations). For the passenger arrival process, the processing time is measured from the moment when customers arrive in arrival gates to the moment when the customers clear customs. ICAO recommends the arrival processing time to be within 40 minutes in 95% cases and the worst case still to be contained in 45 minutes (again except for the passengers required for additional screenings). The Incheon International Airport not only satisfies the ICAO recommended requirements, it far exceeds the requirements by implementing the quality management system. The implementation of the ISO 9001 quality management system has continuously improved the average processing times: 29 minutes in 2005, 19 minutes in 2007, 18 minutes in 2009, 19 minutes in 2011 for the departure processing time; 20 minutes in 2005, 16 minutes in 2007, 14 minutes in 2009, 12 minutes in 2011 for the arrival processing time, as indicated in Fig 5 (Appendix).

4.3. Performance Improvement in Baggage Handling

In order for continuous process improvement in baggage handling, a 6-Sigma quality system is employed for the baggage handling process, and the system focuses on improving the on-time baggage handling performance. As shown in Table 1, the mishandled baggage rate (the delayed baggage rate) in 2008 was 0.69 per 10,000 (equivalent with a 5.31σ level). The rate was improved to be 0.29 per 10,000 bags (i.e., 5.52σ) in 2009 and 0.13 per 10,000 bags (5.71σ) in 2010. Due to unexpected demand increase, the rate became a 5.45σ level in 2011, however, it recovered to be 0.008 (5.81σ) in the first quarter of 2012. Such excellence is an outcome of the 6-Sigma quality management system with a process oriented approach. As indicated in Table 1 (Appendix) mishandled baggage rate in the Incheon International

Airport.

5. DISCUSSIONS AND IMPLICATIONS

In the competitive business environment of the changing airport service industry, the process activities and the improved performance of Incheon International Airport have been established as important factors for the airport to improve service quality and gain a competitive advantage. Stevenson and Barnes (2002) confirmed through an empirical study that the adoption of ISO certification has a positive impact on marketing results. In other words, these authors claim that the adoption of ISO 9000 certification is necessary to support a differentiated business strategy and competitive advantage in business competition. Incheon International Airport adopted the ISO 9001 certification and applied the process approach to continuously develop their processes. Incheon drastically improved the immigration process such that it takes 19 minutes for the departing passengers and 12 minutes for the arriving passengers. Incheon reached a level of performance that is three times faster (departing passengers 19 minutes, arriving passengers 12 minutes) than the international standards (departing passengers 60 minutes, arriving passengers 45 minutes) recommended by the ICAO (International Civil Aviation Organization). The improved process performance and the competitive advantage that Incheon International Airport has gained in the airport industry is demonstrated by the fact that it was ranked first place for seven consecutive years in the list of Best Airport Worldwide for airport service quality, as awarded by Airports Council International (ACI). As indicated Table 2 (Appendix) the Airports Service Quality (ASQ) Top Performers.

This study purposes to provide a few implications for competitive improvements for airport operators worldwide. First, according to the existing literature and previous studies, the adoption of the ISO 9001 quality management system is a necessary key success factor for business performance. In addition, ISO 9001 was found to have a positive effect on the processes to minimize the entry-exit processing times and the rate of mishandled baggage. These results imply that special attention and focus should be given to the ISO 9001 quality management system because its adoption of has a positive effect on many processes. The second implication is that to achieve performance and competitive advantage with an effective and efficient operation, airport operators should achieve the ISO 9001 quality management system certification and should actively seek and make efforts to establish the optimal system for their own airport. The third implication is that the airport operators should pay close attention to continuously improving their processes through a systematic application and realization of the process approach.

6. CONCLUSIONS

The purpose of this study is to found the relationship between the implementation of quality management system and the performance of airport operations. Also, this study aims to provide a few implications for competitive improvements for airport operators worldwide.

This study found a new significant relationship regarding airport operations, which is somewhat different from that found in the previous studies. Moreover, the adoption of the ISO 9001 quality management system certification and the process approach were found to be mutually effective and efficient in a heterogeneous and complex organization, such as an airport operations organization. Thus, we could see that the adoption of an ISO 90001 quality management system by Incheon International Airport has contributed to the enhancement of its competitiveness and the creation of sustainable performance. In addition, ISO 9001 was found to have a positive effect on the processes to minimize the arrival and departure

processing times and the rate of mishandled baggage handling system.

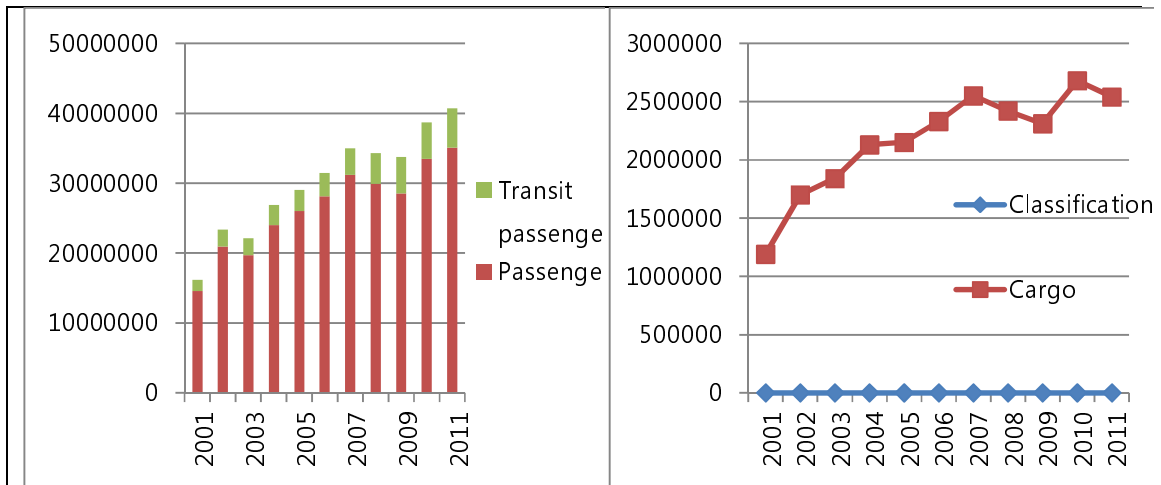
The results of this study demonstrate that it is necessary for current airport operators worldwide to adopt an internationally recognized quality management system, such as ISO 9001, to meet the demands of customers and to survive future competition. First, the ISO 9001 quality management system can improve the performance of airport operators worldwide and can help them to enhance their sustainable competitive advantage by applying an internationally standardized quality management system. Second, airport operators should adopt the ISO 9001 quality management system that meets the characteristics of their airport to establish the optimal system. Third, the airport operators should implement ISO 9001 through a process approach, which can improve competitiveness and create innovative performance, and the operators should continuously make improvements. This study researched the existence of a significant relationship between the adoption of the ISO 9001 quality management system by Incheon International Airport and the airport's subsequent performance. Existing literature and previous studies were examined for this study, which revealed that the process approach is effective in the adoption and performance of the ISO 9001 quality management system. Thus, this study examined the relationship between the adoption of the ISO 9001 quality management system and the performance of Incheon International Airport.

The results of this study show that the achievements of an improved process due to the adoption of the ISO 9001 quality management system certification became the core activities that created improvements in immigration services and minimized the rate of mishandled baggage. Accordingly, the activities taken to improve processes based on the ISO 9001 quality management system should be continuously conducted and examined to improve the competitiveness of the airport operators worldwide. Furthermore, in an era of unlimited competition for survival, airport operators should create new achievements and gain a competitive advantage to establish their position as an outstanding, sustainable airport.

An examination of the theoretical and practical contributions of this study shows that its theoretical contribution is a theoretical extension that applies the adoption of the ISO 9001 quality management system and process improvements for the airport industry. The following are the practical contributions. First, this study contributes by providing a foundation to support the need for airport operators worldwide to adopt and establish ISO 9001 quality management systems. Second, this study encourages the expansion of both the ISO 9001 quality management system certification and the ISO 9001 quality management system activities for airport operators to enhance their global competitiveness. Third, this study supports the ongoing management of performance through the ISO 9001 quality management system activities and improvements. Fourth, concerning the scarcity of recent studies on the achievement of ISO 9001 quality management system certification, this study encourages research into various aspects of airport operations. Fifth, by understanding the ISO 9001 quality management system and raising the awareness of the process approach, this study fosters the ability to promote the business effectively and efficiently. Sixth, this study provides useful information for achieving new performance levels by closely combining processes from each part of the operation and continuously making improvements.

This study investigated Incheon International Airport; other general businesses with different organizational structures and cultures were not examined. However, future studies could expand this topic and discuss other world airports and other businesses as their subjects. Also, it is necessary to investigate empirically the interrelationship between the ISO 9001 quality management system and the effects of these interrelationships on airport organizations, as well as general businesses. Lastly, this study provided insight into methods for the successful growth and development of the airport operators worldwide to achieve excellent airport operations and a sustainable competition advantage.

APPENDIX



Graph legends: green in the first graph means "Transfer Passengers"; red in the first graph means "Passengers." Blue in the second graph means "Classification"; red in the second graph means "Cargos"

Fig. 1 Passenger and Cargo Traffic of the Incheon International Airport

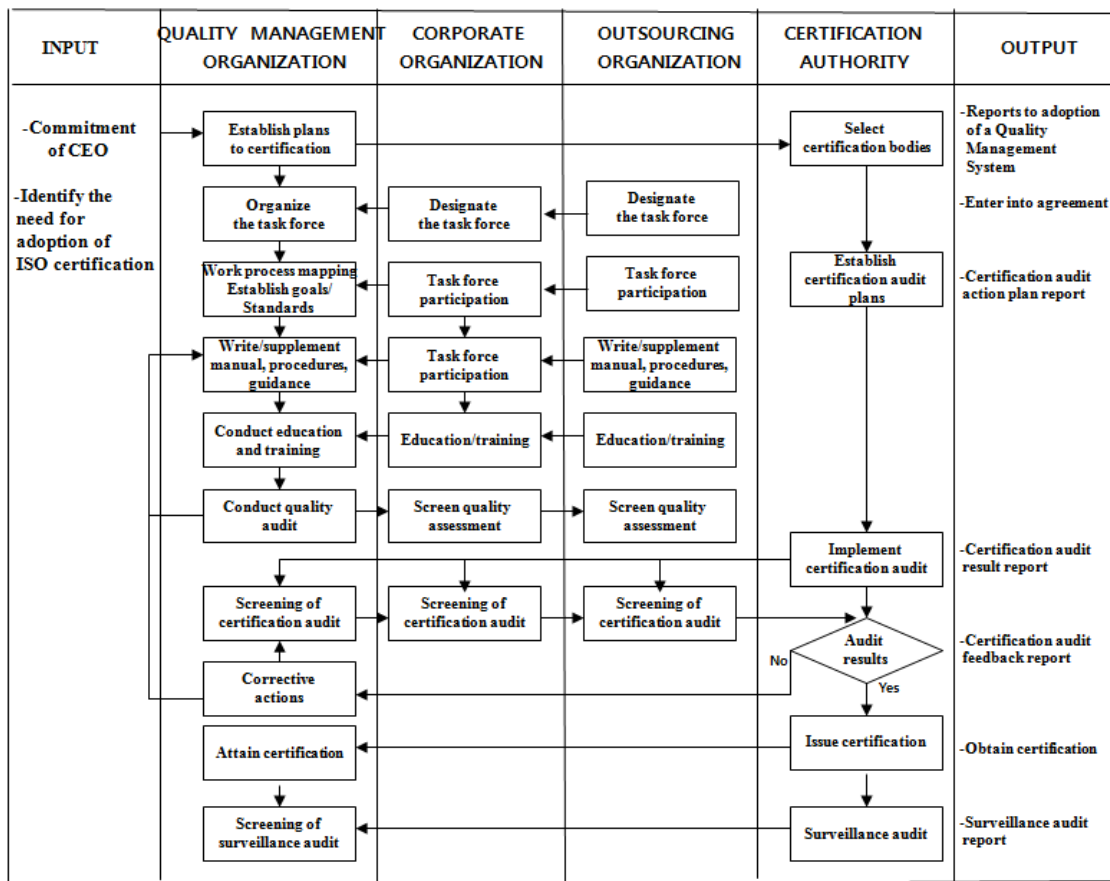


Fig. 2 Process of ISO 9001 Certification Acquisition

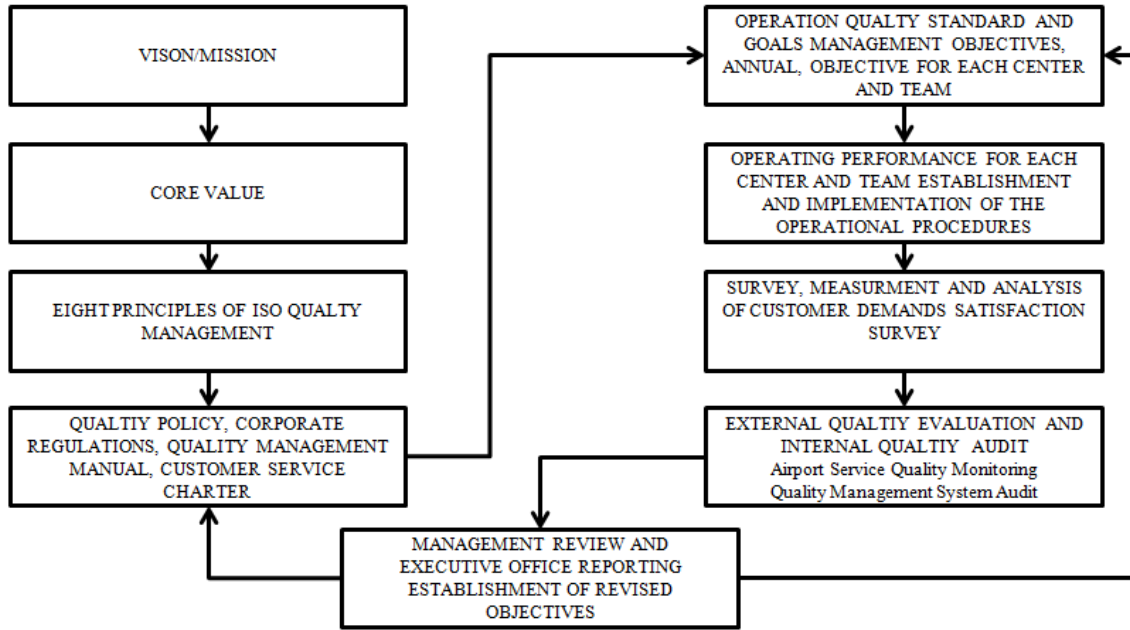


Fig. 3 Concept for the Establishment of the Incheon International Airport Quality Management System

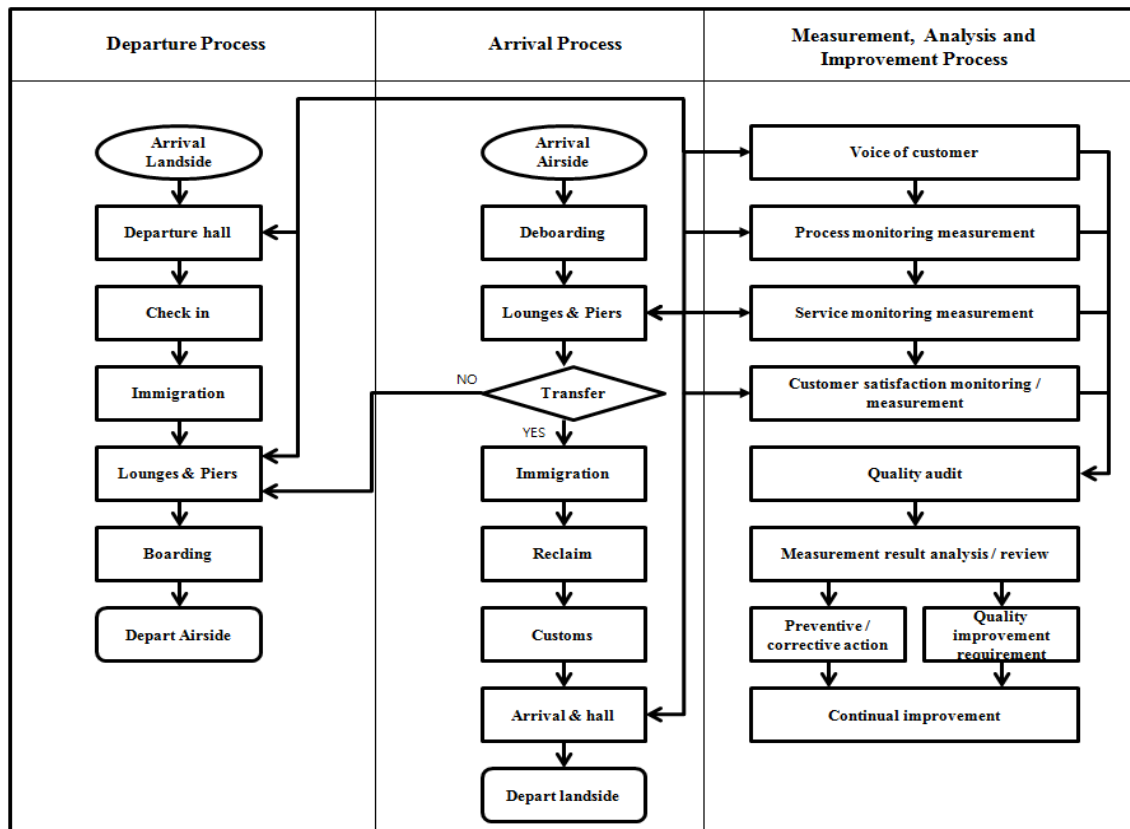
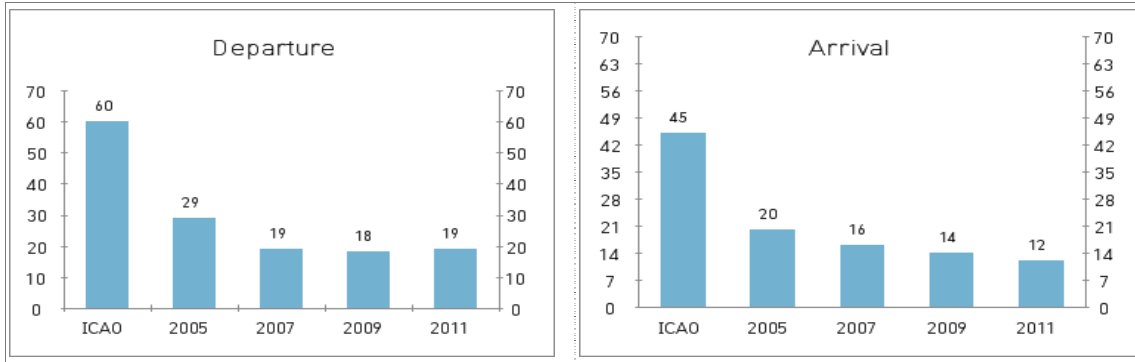


Fig. 4 Airport Operation Quality System Based on Interrelated Processes



Notes: Left graph <Departure>; Right graph <Arrival>. The x-axis: ICAO International Standard; year 2005; year 2007; year 2009; year 2011. Each bar represents the number of minutes indicated.

Fig. 5 The Average Processing Times at the Incheon International Airport

Table 1.
 Mishandled Baggage Rate in the Incheon International Airport

Classification	Number of Delayed Baggage (Pieces)	Number of Baggage Handled (Pieces)	Delay Rate (6σ)	Delay Rate (For every 10,000 pieces)
Year 2008	659	9,483,051	5.31	0.69
Year 2009	494	17,065,246	5.52	0.29
Year 2010	258	19,436,240	5.71	0.13
Year 2011	811	20,567,408	5.45	0.39
Year 2012	42	5,474,784	5.81	0.08
Total	2,264	72,026,729	5.51	0.31

Notes: Delayed baggage expressed in (6σ) Six Sigma.

Table 2.
 ASQ Top Performers

Rank	Best Airports Worldwide						
	2011	2010	2009	2008	2007	2006	2005
1	ICN	ICN	ICN	ICN	ICN	ICN	ICN
2	SIN	SIN	SIN	SIN	KUL	HKG	SIN
3	PEK	HKG	HKG	HKG	SIN	KUL	HKG

Source: Airports Council International Media Release data organized by the researcher
 Notes: ICN=Seoul Incheon, SIN=Singapore, KUL=Kuala Lumpur, HKG=Hong Kong, PEK=Beijing. The year 2005 shows the results of a joint survey by the Airports Council International & International Air Transport Association.

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