Facilities

Developing key performance indicators for airport safety and security

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Abstract

Purpose – The purpose of this paper is to outline the findings from a research project seeking to develop and test a set of key performance indicators for airport facility management, with particular focus on safety and security.

Design/methodology/approach – A case study approach was adopted for this project and data was collected from a series of interviews, workshops, the internet and other media.

Findings – The need for airport security and safety is paramount, post 9/11. Airports generate revenue from the facilities they provide so they seek to maximise their potential revenues but must do so with safety and security foremost in the operators' minds. In the UK a system for boosting security at the airports termed "multi-agency threat and risk assessments" has been developed jointly by the Department for Transport and the Home Office after Sir John Wheeler's report on airport security and policing in 2002. This provides a framework for this research and enables the evaluation of current practice to be undertaken.

Originality/value – Previous research has not directly measured the relative performance of airport safety and security and the role of facility management in achieving that level of performance and this is the focus of the study. This paper concludes by presenting a potential list of key performance indicators for airport safety and security that emerged from the interviews and workshops.

Keywords Performance management, Airports, Safety, Benchmarking, Performance measures, Scotland

Paper type Research paper

Introduction

The need for airport security and safety is now a major concern for all governments around the world. Terrorist activities are increasingly common and an unfortunate reality in today's world; the shocking images of the 7 July 2005 London bomb attack, the 11 March 2004 train attack in Madrid, and the 11 September 2001 attack on world trade centre in New York remain fresh in our minds. This study considers risk management in airports, in particular relating to safety and security issues as part of the facilities management process in the delivery of an airport "service". The key research aim is the examination of the assertion that facility management is vital in improving the performance of airport facilities and in particular to develop and test a set of potential key performance indicators for airport safety and security. The paper proposes a set of key performance indicators for security and safety issues developed from a literature review and three pilot case studies of Scottish airports. The initial literature review considers four specific, interrelated areas risk management, performance measurement, benchmarking and the role of key performance indicators (KPIs) in improving performance

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Risk management as a methodology for assessing risk and safety

Different strategies are employed in risk and safety assessment today. Risk management is about risk perception, risk identification and risk audit. Value engineering uses value programs to achieve their objectives, this methodology can be used to attain many objectives depending on the goals set for attainment, value programs can extend the use of resources by eliminating unnecessary cost without sacrificing quality, and time. In risk management, the use of warning signals and proper identification of sources of potential hazards are vital parts of the management process.

Frewer *et al.* (1998) in their study of the principles of risk perception applied to gene technology, were of the opinion that the level of perceived risk of a new technology or product is an important early indicator of the public's alertness about its potential hazards. Probably even more important, is the fact that they are not willing to accept some applications of these technologies without previous and thorough debate on their implications and potential hazards Frewer (2003) and Robinson *et al.* (2000). Risk identification is very important stage in any project risk management plan. It involves the recognition, filtering and ranking of potential risk or uncertain events that may take place during the project life cycle. A risk audit is embarked on to identify all possible risk associated with the project, most cases a risk workshop is organised to identify these risk and solutions are then discussed that will be robust enough to mitigate these risk. In the aviation industry, there are checklists every where including the airports mainly due to the high-risk environment in which workers operate, this industry has adapted both paper and electronic checklist as tools to help decrease human error. The use of these checklists is highly regulated in aviation and under some conditions; it is considered mandatory practice. Under these circumstances, the checklist becomes flight protocol, and completion of a checklist from memory is considered a protocol violation or pilot error (Hales and Pronovost, 2006). Risk management is mainly about, identifying potential setbacks and measures that will help overcome them as they occur or prevent them from taking place.

Performance measurement

Measurement is still one of the critical aspects of today's management, just as it has been in the past being, a key aspect of scientific development since the seventeenth century. The concept of performance measurement has been embraced by facilities managers and project managers, who increasingly use it as a benchmark against which effectiveness can be measured, and a basis for which improvement can be determined.

Sinclair and Zairi (1995) reveal the need for measurement in enabling good planning and control, continuous improvement, resource allocation, motivation and long-term focus judging it to be a valid management tool. While Loosemore and Hsin (2001) believe that the greatest influence on the organisation's core objectives is the functional performance of its property, which can account for 80/90 per cent of its total costs. Varcore (1996) says that applying the disciplines of performance measurement helps managers and operators alike to determine those issues that are crucially important to the overall organisation and its success, also those issues that similarly are crucial to the successful delivery of the specific function or operations concerned.

All measurement must relate physical, functional and financial attributes on the one hand and also consider customer satisfaction, flexibility and productivity on the other. A good starting point is an understanding of the organisation's goal, aims and objectives and then you relate them to the organisations mission. The result of performance measurement will tell how well the organisation is doing against predetermined goals, assess the strength and weakness of the organisation and help in establishing standards. Performance measurement in relation to the delivery of effective service; will involve delivery that is timely and orderly, without waste a non value adding activity in facilities management. We can also learn a lot from operational services or cost centres, functional use of space, financial performance and other performance when measurement are involved.

The success and growth of the industry demands attention be paid to performance levels and the measurement of those performance levels and this is where benchmarking can play an important role (Vogel and Graham, 2006).

Benchmarking

Benchmarking is a strategic planning tool aimed at clarifying the objectives and logic of any program. Performance indicators can help inform resource allocation decisions, when used to direct resources, to the most successful activities thereby enhancing efficient use of resources. It can also provide means of improving programs by learning from success, and improving the performance of the program. The benefit lies on their measurability and the fact that performance levels are derived from specific program or project objectives. Benchmarking provides a powerful combination of tools that can allow any organisation to identify areas where performance could be improved. Comparison between the best in the industry and different organisations is important and is termed external benchmarking as well as internal benchmarking. The need for continuous improvement is the core of development, which requires a very clear picture of how things stand today. The benchmark serves as a standard against which relative performance can be measured, this can be either internal or external but the essence is having a point of reference.

Financial and cost data, airport economic efficiency and retail performance have previously been benchmarked by Loosemore and Hsin (2001), Bowerman *et al.* (2002), Arrowsmith *et al.* (2004). Generally benchmarking in airports are common practices, specific task may be targeted for improvement and will therefore be the centre of the benchmarking exercise for instance the airport might seek to improve the management of their car park by benchmarking it against ticket sales at football stadium just like BAA did with the old Wembley stadium. Previous airport benchmarking studies tend to compare airports across Europe. Benchmarking and performance measurement of facilities, and of the facilities management process, is a very well researched area in recent years. Hinks and McNay (1999) were able to develop a set of key performance indicators for measuring the facilities management function of a financial service company by a process they called "management by variance", which is based on performance trend monitoring and analysis. Using this approach they were able to monitor and analyse performance trends by using a, bespoke set of performance indicators employing a Delphi group in the research process. In their study there were no general performance indicators for the FM function, and there was the need to

clarify and prioritise indicators that correlated the views of the customers and goal of the study.

There is limited literature on the subject of the management of airports in the field of transportation. Here the focus tends to be on airlines and airline performance. However Kazda and Stanley (2000) are of the view that you cannot design an airport without a sound knowledge of its operations, as poor design will affect the operations of an airport and result in increasing costs. Most studies on airport performance tend to look at economic performance and operational performance and more recently environmental performance. This study is focused on developing key performance measurement for airport safety and security, as way of assessing airport safety and security purely from facilities perspective.

In looking at benchmarking and performance measurement in public sectors Kouzmin *et al.* (1999) agreed that because of the relative early stages of the introduction of benchmarking into the public sector their acceptance is unwholesome with scepticism and anti organisational change element within the workplace resisting every effort. Managers can use benchmarking as a management strategy to measure performance; also to evaluate, budget, motivate, control, learn, improve, promote and plan. It may be possible to combine all or some of these attributes in one measure but there are no guarantees that this is the case. Managers should therefore, think seriously about the managerial purposes to which performance measurement relates and how they might be used. Only then can they select measures with the characteristics necessary to help achieve each purpose.

In relating performance measurement to cost, quality and time Neely *et al.* (1995) says managers find it easy to decide on what to measure. Once a performance measurement system has been has been developed it has to be implemented both within and outside the organisation. To date performance measurement has been used to monitor past performance, laggard indicators and stimulate future action. Increasingly the world is looking for leading indicators measure that will predict like the statistical process control (SPC) measures that will predict fault before it occur.

De Toni and Tonchia (2001) believe that in spite of the increasing importance of performance measurement in operations management very few empirical studies concern models and to make the very best of the system they propose integration and formalisation with firm system as of prime importance, while at the same time creating greater space for human resource considerations. Benchmarking can also have its own drawback. Synnestvedt (2001) identified a number of barriers to performance benchmarking including the fact that data or information exists in a number of guises; not all relevant information exists; the language is often technical; there can be measurement problems; there are statistical lags; the available information can often be hard to verify and the format of the information might make comparison very difficult. In collecting data and proposing measurement systems for airport safety and security all of these issues had to be addressed.

These previous studies sort to measure different types of performance. And previous studies on KPIs tend to emphasise profitability, economics and environmental issues and recently issues on sustainability. But this research work looks at performance purely from the point of view of facilities considering the huge investment most organisation put into facilities, specifically airport facilities. This

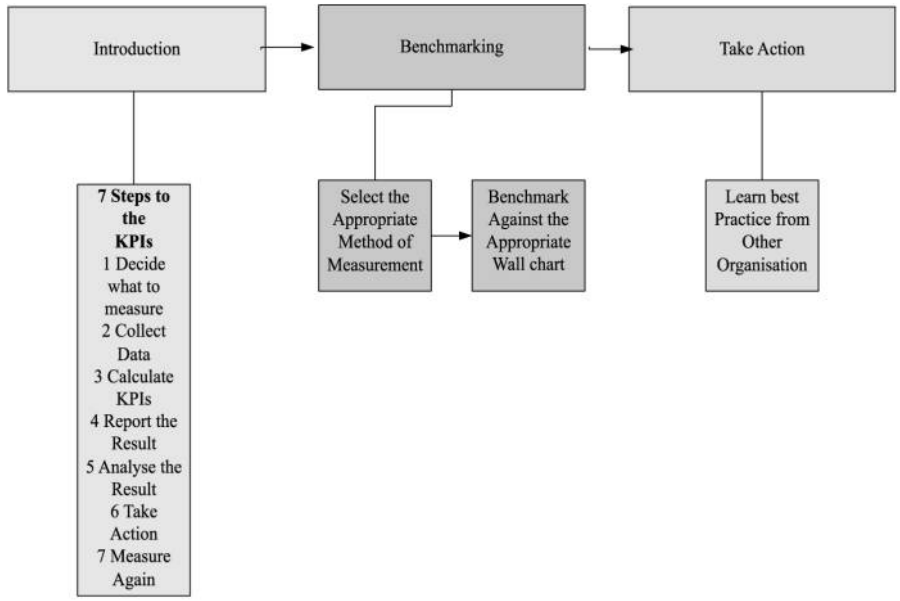
study differs from previous studies, as it concentrates on looking at how FM impacts upon airport performance. Let us examine the role of key performance indicators.

The role of KPIs

Key performance indicators are a very broad concept making the design of KPIs very difficult for both private and public sector organisation. Performance indicators are not an end in itself so there is the need to think very carefully about its application – Behn (2003) on his question why should public managers measure performance? He also answered it as the fact that they may find such measures helpful in achieving specific managerial purposes. Relating the challenges of the functional performance of the facility and the organisations objectives, Valins and Slater (1996) express the difficulty that exist with measuring the impact of buildings upon the emotions, attitudes, behaviour and both performance levels and satisfaction of those who use them. Most KPIs in facilities management relate to cost of operation, maintaining and running a facility, revenue generated space usage and management, environmental, and health and safety issues.

KPIs have a crucial role to play in improving the reputation of the construction industry. The Scottish Enterprise model is applicable to the Scottish Economic, Respect for people and Environmental KPIs and at the same time relevant to firms using other UK sets of construction industry KPIs (Scottish Construction Forum, 2007).

As illustrated in Figure 1, KPIs are seen as measure of factors critical to the success of the organisation. It is a very simple method of measuring performance; you start with the seven steps to the KPIs, then you benchmark both project and performance



Source: Scottish Construction Forum (2007)

Figure 1.
KPI development and implementation

against others and use the information to set improvement targets. And track your performance trend and also compare against information available from other sources.

Both the Latham (1994) report and the Egan (1998, 2002) reports identified the problems, of the UK construction industry, and have contributed immensely to understanding, what it is today. While Latham advocated the use of total quality management (TQM) as a solution to the construction industry problems, Egan on the other hand saw integrated teamwork, partnering, client satisfaction, and profitability as the way forward. The target set by Egan (2002) are areas, where there is the need for performance indicators, as a means of measuring and keeping with the targets.

There is no consensus on the use of performance indicators in the aviation industry. Doganis and Graham (1987) agreed that a few airports have developed and used performance indicator, but there is no agreement on which indicators might be used, or even an acceptance of the value of such indicator, so there is the need to develop and test KPIs for use in the aviation industry with particular reference to safety and security at the airports which this study seeks to address.

While the study by Doganis and Graham tended to concentrate on the potential use and validity of performance indicator as a management tool for airport. This research will develop and test KPIs for airport safety and security and the role of FM in improving performance at the airport. Performance indicators are meant for comparison, i.e. trends from on period to another or from one airport to another. With the potential KPIs to be developed in this study it will be possible to compare safety and security between two different airports irrespective of the size and location.

Amaratunga and Baldry (2003) examined the basis of performance measurement in FM by looking into the advantages and disadvantages in the current measurement system to develop a conceptual framework. Brackertz and Kenley (2002) applied a holistic model to provide an appropriate measure of facility performance that included financial and non-financial indicators in their study of the service delivery approach in local government authority in Australia. Gilleard and Yat-lung (2004) applied analytic hierarchy process (AHP) in benchmarking FM performance which is a very useful measure when it involves multi-attribute multivariate qualitative and quantitative data however the process involves ranking and weighting which involves applying sensitivity testing some element of subjectivity. Common in the literature of FM is objectively measuring performance in an economic and repeatable manner. Finch (2002) in his research paper on automated information in performance measurement acknowledged effectiveness as a measurable concept and explored the value that can be derived from network device in relation to performance indicators.

Performance indicators are used for analysis of past performance and the result are used by management to inform resource allocation also to enforce benchmarking decision. If the result identifies failings in the response time for say facility maintenance at the airport, management can then use this to plan for future maintenance and even set targets for the workforce to meet. Performance indicators can be used to establish standards against which every other measurement can be pitched and interpreted; it can also be used to identify data required and point out the shortcomings in the available data.

Performance indicators can aid comparison like for like so it will be possible to compare the operations of different airports and also compare internally operations of the same airport overtime. Comparison may be a problem sometimes to avoid this,

there is the need for careful interpretation only to be undertaking by people with extensive knowledge of the details of the measurement, frankly without such guidance from experts indicators may be of limited use and subject to misinterpretations.

Financial measures and indicators have been the main measure of corporate performance over the years. And they are widely accepted and easy to use and understand. Things like profit and loss, revenue, income and expenditure, cost and benefits are everyday words you do not necessary have to be an accountant or financially trained to use them. But in today's world limiting performance measurement to financial is outdated because the indicators are derived from outdated and arbitrary cost accounting principles.

The need for a standard set of performance indicator for measuring airport performance is long overdue. The use of financial indicators is not only insufficient it is outdated, and the emphases on profit will not be helpful, without corresponding increase in efficiency and effectiveness at employing resource to create very high levels of services for customers. However the key issue is in determining specific indicators that are applicable to the aviation industry.

The demand for airport services is relatively inelastic, meaning that the extent to which they can attract other airport customer is not dependent on the price they charge. There are certain factors that attract people to certain airports. First is the feeling of safety and security, no matter how low, the price an airport charges, if the passengers do not feel safe they will not use it. The range of service available at the airport will also determine the level of comfort provide for the users of that very airport. With all these problems in mind there is the need to develop a generic set of KPIs that will be acceptable in facilities management for use in measuring airport safety and security which is the objective of this study.

Methodology

Following an initial literature review, the methodology adopted for the development, testing and validating the set of KPIs for airport safety and security is a combination of case studies involving the use of structured interviews with key airport personnel supported by questionnaires, observation and workshop.

Literature review

The literature review was structured in four areas: risk management, performance measurement, benchmarking, and key performance indicators. Previous studies identified in the literature review earlier tend to compare airports across Europe but this study concentrates on Scottish airports. The rationale behind the focus on Scottish airports was the logistics to accessing key people at each airport and collecting relevant data in conjunction with the belief that to some extent operating procedures will be similar across the world in terms of the security and safety function. A more international perspective is perhaps an additional research activity for the future and is outside the scope of the current project. Also examined were previous work in the field of airport performance indicators and facility management. Performance indicators used in various other industries were examined and helped in the generation of a potential list of KPIs for use in the airports that were discussed in the initial interviews. Having reviewed a number of possible performance models an initial conceptual list of KPIs for Airport FM based upon Hinks and McNay (1999) was developed and this

formed the basis of the pilot study. The intention was to validate this list with a small number of industry experts and then, go on to form the basis of a larger round of interviews and questionnaires focusing upon airport safety and security for the initial identification of the set of KPIs presented in this paper.

Pilot study

The pilot study was the very beginning of the survey, after the initial literature review. In the scheme of empirical investigations there are many methods, including case studies, factor analyses, experiment and survey. Pfleeger and Kitchenham (2001) advised that after deciding on the method, the focus will then shift to, how to organise, administer and analyse the study in other to get useful and meaningful result. In this study the pilot survey gave us an indication of what to expect in the real survey because it was carried out with the same class of experts, experienced in facility provision for the aviation industry. This gave the study a big lift as result suggested that the list of KPIs generated was not aviation specific enough and that the work of Hinks and McNay were too general for our study. So the review of the pilot survey informed the structure of the subsequent rounds of interviews and questionnaires.

Interviews and questionnaire

The interview phase involved speaking to a number of managers, at different times in the airport premises and a time slot of about an hour each, was spent in asking and answering questions, and became iterative as further information was requested and followed up on. The same set of questions were sent out to the managers of each of the airport teams as well as others involved in the day to day running of the airport in all a total of thirty questionnaires were sent out and a response rate of 40 per cent was recorded with the questionnaires.

By focusing upon airport safety and security, the focus was on risk management, it is vital to recognise the importance of having a clear and effective approach for the identification and management of mission-critical risks. Key questions that the interview round sought to identify and which formed the basis of the structured interview were as follows:

(1) What are the top 12 mission critical risks to the airport?
(2) How and why have they been ranked as such?
(3) What are the procedures for managing them?
(4) What are the key strategic systems in place?
(5) What demonstrates that these risks are effectively managed?
(6) How will the airport know if the management of these risks begin to fail?
(7) What will ensure we respond effectively if it does begin to fail?
(8) Where are we?
(9) Where do we want to be?
(10) What is preventing us from where we ought to be?

The next stage will be workshops to test and validate the proposed KPIs.

Workshops

Following these case study interviews an amended list of KPIs was identified and further developed at a number of workshops that sought to validate the safety and security KPIs based upon two broad classes of incidences, "airport incidence" meaning any breach or emergencies that occurs within the airport and "aircraft incidence" that occurs outside the airport but inside the aircraft. This amended list is discussed at the end of this paper and it is proposed that this amended list will be In addition it is envisaged that once an approved list of KPIs has been developed further research will be undertaken with the airport teams to identify the following in relation to each KPI:

- priorities;
- measure of success; and
- targets for performance improvement.

Priorities were meant to give information on the operational procedures adopted during the occurrence of any incidence relating to the KPIs in the list.

Measure of success was the KPIs itself, its gives information on the efficiency and effectiveness and the resources available for dealing with the issues involved.

Target was a kind of benchmark for improvement, an indicator of how well the airport was doing with the resources available.

In addition, it is envisaged that once an approved list of KPIs has been developed further research will be undertaken with the airport teams to identify the impact of each, on the airport facilities, and if does have a design implications for the airport facilities.

From these set of interviews a final set of KPIs was then reached which will be validated by expert opinion.

Reflections on the case studies

"Multi-agency threat and risk assessments" (MATRA) is a system developed jointly by the Department for Transport and Home Office after Rt Hon Sir John Wheeler's report on aviation security and policing in 2002. MATRA presents a national model for the UK and Glasgow was one of the five UK trial airports. Since this trial the system has been implemented at all UK airports and provides the framework for understanding safety and security in UK airports. The system is designed to provide accurate assessments of the threat to an airport from crime and terrorism; identify weaknesses in the existing security arrangement and also to contribute to the development of an airport's risk management strategy. Each airport has its own MATRA member drawn from the local representative of stakeholders, government and interested security operatives. They meet regularly to adopt and implement security plans and procedures that are owned and local to them.

Risk assessment and management under MATRA, involves determining the likelihood and the probability of an occurrence of risk and developing action plans to address the situation that can ensue, making sure that the mitigating actions are robust and dependable. The assessment of threat, the consequences and the likelihood of occurrence with their impact and severity MATRA is based on information gathering and sharing of learning. Each of the case study airports is fully involved in MATRA and they share information and learning and are paid regular visits by the Department for Transport (DfT) to monitor the level of application and involvement.

The three BAA airports in Scotland that were involved in the study were Glasgow, Edinburgh and Aberdeen with particular focus upon Glasgow as it is currently the busiest Scottish airport with passengers numbering 8.7 million in 2005 and expected to reach 13 million by 2015 contributing over £700 million annually to the Scottish economy. Currently GIA has over 100 flight destinations and 50 airline partners. On current forecasts it is anticipated that Edinburgh will become Scotland's busiest airport in the next five years but is of a similar size and scale to Glasgow.

At Glasgow, which operates in a similar manner to the other airports, there are a number of different teams running the affairs of the airport such as the terminal team, the security team, the facilities team, project team, the airfield operations team and the community relations team.

These teams illustrated in Figure 2, were the focus of the initial round of interviews and questionnaires and will participate in the workshops. Other stakeholders at the airport and professionals with relevant knowledge and experience in the management and design of airport facilities as well as risk and business continuity planning professionals were also contacted during the different phases of the study.

Measuring airport performance

A useful starting point in the case study investigation was the question – how do we know an airport is performing well? Historically airports have compared their outputs in terms of passengers handled, the number of passengers that passes through in a given period, aircraft movements and freight processed. The literature review indicated that there is not one single answer to this question, responses elicited from the fieldwork also suggested the same. An airport can determine, if it is doing well

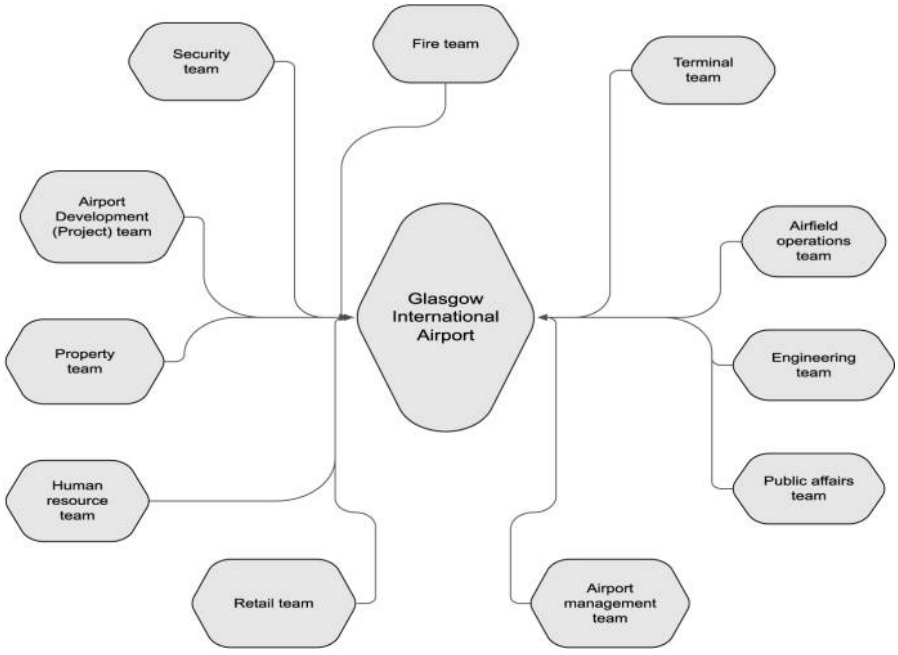


Figure 2.
A drawing representing all the teams that makes up Glasgow international airport

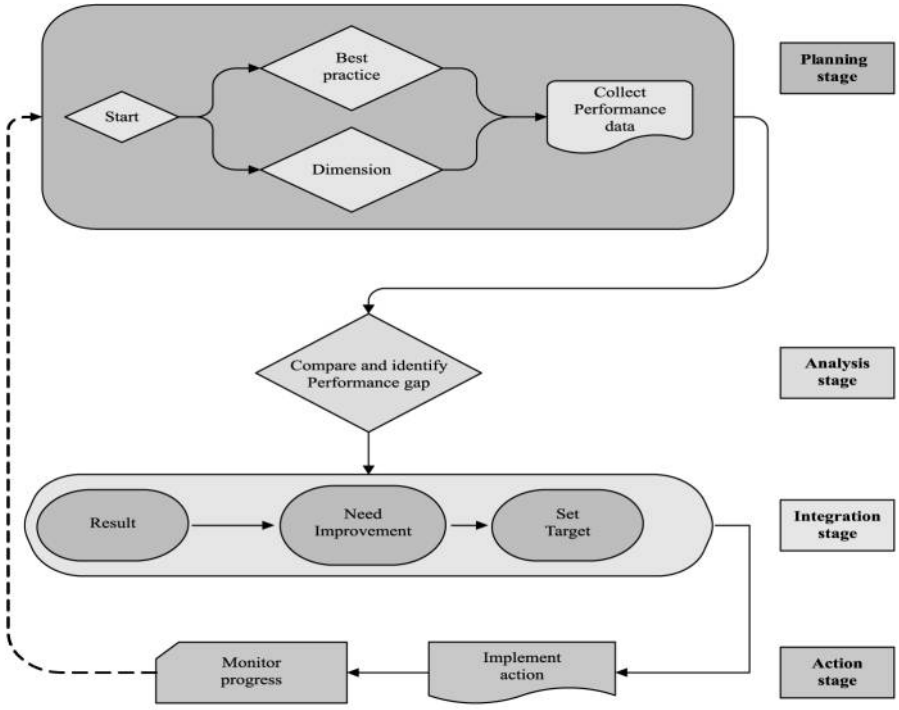
based on the results, of indicators in use, or target achieved, and expectations met. It can also use the level of service delivery to determine it. The airport impact on business partners and the environment as well as the result on benchmarking can go a long way in determining the performance.

Airport performance measurement is about risk management and determining the best risk management route for the airport by ensuring that everything is in place for an effective monitoring and assessment system. It is also very important to have a feedback system in place and to carry out periodic review of the entire system. External assistance in the form of seeking expert opinion or independent facilitators to help provide objective and unbiased view of the situation on ground, it is equally necessary to keep the airport on track in attaining organisation's goals and mission. At Scottish airports risks are managed at the front end, each department is responsible for managing their own risk.

The interviews identified that the Scottish airports operate a 24-hour service; essentially standard operating procedures mean that an airport should always be ready for an emergency when it occurs. Robust emergency plans, contingency plans and business continuity plans should always be in place to reduce the consequences and the likelihood of occurrence of threat. Each airport maintains an overall risk register and every department has its own individual a risk register. The top 12 risks to the airport are reported to the corporate office and each airport has its own risk manager that records and operates the register on behalf of the airport. In addition the airport has to ensure that there are measures in place to control and mitigate the risk, these measures should be capable of dealing with the risk involved. All incidents that have severe consequences or likelihood of occurrence must be dealt with by a contingency plan.

As business grows and the task of delivering a smooth airport operation increases, in relation to benchmarking airport performance, in its latest UK regulatory review completed in 2003 the Civil Aviation Authority (CAA) makes it mandatory for airports to internally monitor and set targets for their service quality. Refunds will be given to users if certain targets are not met and hence measurement of performance will become a more important aspect of service delivery. Recently Australian airports were required to benchmark internal performance only rather than external comparison with other airports. Benchmarking is generally more accepted by the operators in the industry now than they were two decades ago and this provides scope for this study into benchmarking airport safety and security. Leake and Stanley (1994) identified four stages in the facility benchmarking process that comprises ten steps. These are summarised below and outlined in Figure 3:

(1) The first stage is the planning stage which has three steps:
    - Identify facility performance dimensions to be benchmarked.
    - Identify best practices to compare with.
    - Collect performance data (this data will relate to the KPIs).
(2) Stage two – analysis has two steps:
    - Compare with best practice and identify performance gap, then. (findings)
    - Determine how to improve performance.
(3) Stage three – integration has three steps:



Source: Based upon Leake and Stanley (1994)

Figure 3.
An illustration of the facility benchmarking process

- Communicate result or findings and gain acceptance of the need for improvement.
- Establish performance goals or targets.
- Develop action plans and implement strategies.

(4) Stage four – action has two steps:

- Implement specific actions and monitor progress and recalibrate benchmarks and update with ongoing changes.
- Monitoring and evaluation is more compelling because it is objective.

The key point to note about Figure 3 is that, to undertake any benchmarking activity the starting point must be an understanding of the dimensions to benchmark and perceived best practice. This study addresses the issue with respect to airport safety and security. A starting point in this process is to understand the key functions and objectives of an airport to understand what needs to be improved upon. The literature review and initial interviews conducted, assisted here; in particular (Doganis and Graham, 1987) identified the main functions of an airport to be:

- The provision of facilities for aircraft, runways, taxiways, aprons for use of airlines and their agents, air traffic control (ATC), landings and aircraft parking. ATC charges are levied to cover cost.

- The provision and operation of terminals for pre-flight and post-flight activities or formalities for passengers, this also includes the processing of baggage.
- The provision of space within the terminals for shopping, catering, and other retail business services like bars and restaurants, car parking services, car hire, newsagents and foreign exchange facilities.
- The provision of ramp and traffic handling services.

It is likely that safety and security issues will have an impact in each of these areas and data collected from the case studies presented below explores this further.

Current security arrangements

The Department for Transport (DfT) is the government department responsible for airports and transport reviews. Aviation security operates at three levels, namely international, national and local (pertaining to an individual airport). At the international level there is the International Civil Aviation Organisation (ICAO) and the European Civil Aviation Conference (ECAC). The UK is an active member of both bodies and signatory to international treaties and agreement on civil aviation security. The Chicago convention in 1944 on civil aviation set out the basis for today's airport security arrangement and is one of the most important agreements in aviation history and provides the basis for international aviation security.

The UK has obligations under both the convention and the annexes. The principal annex dealing with international aviation and airport security is Annex 17 whose main objective is to ensure that passengers, ground personnel, crew and the general public are safe guarded from acts of unlawful interference. At BAA group, each of the case study airports, they ensure that the principles applied to international civil aviation are also applicable to domestic aviation.

For efficient and effective implementation of security objectives most airports operate with two major zones to protect those assets that are mostly at risk, i.e. aircraft, the tarmac, the apron, the ramp, the hangers and cargo sheds. The two zones are termed the "restricted zone" (RZ) and the "controlled zone" (CZ). The restricted zone is defined in section 11a of the aviation security act of 1982 as amended by the aviation and maritime security act 1990 as "the whole or any part of an aerodrome designated by the secretary of state as restricted zone". The controlled zone relates to areas not designated as a restricted zone, part of the airside or other areas of the aerodrome, access to which is controlled in accordance with Department for Transport (DfT) criteria such as ID and/or vehicular passes. In addition, there is also airside and landside to consider. The airside is defined as the movement area of an aerodrome including runways, taxiways, aprons adjacent buildings, portions of buildings and the adjacent grounds areas contained within the aerodrome perimeter. The landside is all areas within an aerodrome boundary not designated as a restricted zone, controlled area or other airside area.

Entrance to these areas or zones is based on "reasons for being there". For the travelling public/passenger the entrance to the RZ is strictly by the possession of a boarding pass which will indicate the date and time of flight, the name of the airline, your destination, the flight number, your name and the airport where you are flying from. The passenger and their carryon bags are then subject to security screening on-route to the departure lounge, where they await their flight. Out there are shops, bars, restaurant and amenities to engage the passengers' time before the flight. Outside

the departure areas the passenger is not allowed without escort to other airside areas. When it is time for the flight the passenger is escorted by the airline staff through the piers to the waiting aircraft.

While in the airside apart from the departure lounge, other areas are off limit to everybody apart from those employed by the airport with the right identity cards. There are swipe machine at every entry door that can read airport ID cards and determine if you have access or not to the area you are entry. Some of these areas are physically manned by security officers who will always check your ID cards looking at the photograph and check swipe for verifications.

There is a central staff search area were every worker at the airport report to at the beginning of their shift. Here they are screened and their belongings also screened before they are allowed to the different zones. Their identity card depending on the colour and restrictions allows them through the different doors to where their services are required within the aerodrome.

Proposed key performance indicators

Based upon these initial investigations a draft set of key performance indicators have been produced which will be tested and validated in the next stage of the project. The proposed set of key performance indicators for safety and security are briefly outlined below (Table I).

Breach of security – a few examples to elucidate. The Bahamas journal in an exclusive report says chaos erupted briefly at the Fort Lauderdale/Hollywood international Airport after a formal employee of Bahamas air breached a security checkpoint and attempted to travel on an outdated boarding pass (Connolly, 2006). "Security breach at Dublin Airport, a security staff is been retrained after waving a DFT officer through, without screening, the DFT officer having flashed an official badge was allowed through. Failure to vet procedure was however reported against the staff. Only Gardai are permitted to pass unchecked through airport security. Congressman Steve Rothman (2006) in Washington, DC …". Today's accident is yet another indication that Teterboro Airport is a disaster waiting to happen. If an 18-year-old can accidentally breach the security fence and drive straight onto the tarmac into a fully-fuelled aircraft, just imagine what a psychopath or terrorist could do. BBC News Sunday, 30 December 2001, 11:13 GMT Probe into Heathrow security breach. A man was said to have pulled out a miniature cleaver, a four inch dagger and a three inch stiletto knife on the plane en route to Manchester the weapons were disguised as a comb, a pen and a credit-card seized piece of metal and this happened just a few days after the British shoe bomber, Richard Reid, who is suspected of trying to detonate explosives in his shoes on board a US-bound flight.

In the event of a breach of security, the speed at which the person in breach is located and dealt with is vital for efficient operations because the airport is shut down during breach. Achieving this can be facilitated by:

- CCTV;
- airport control centre;
- communications between officers; and
- uniform direction of passenger movement.

Table I.
The proposed set of key performance indicators for safety and security

KPI	Priorities	Measures of success	Target
Breach of security	Priority in the event of a breach of security is the speed at which the person in breach is located and dealt with achieving this can be facilitated by: CCTV Airport control centre Communications between officers Uniform direction of passenger movement	Following a breach of security, the airport is shut down and a possible KPI will be the time between shut down and reopening	Target – set a reduction target based on past trends
Evacuation in the case of emergency[a] (A) fire (B) bomb threat (C) acts of terrorism	Priority – is the speed of evacuation (depending on the threat, e.g. fire, bomb, acts of terrorism) achieving this can be facilitated by: Clear communication through the public address system Clear signage to the nearest assembly point Unobstructed route to the nearest assembly point The efficiency and effectiveness of the security officers in responding to the incidence	Key measure of success – the time it takes for business operations to begin after the incidences	Target is to eliminate threats within your control and put in place emergency measures for those outside your control
Hysteria control	Priority – the speed of getting things under control and this will be facilitated by: Effective communication to friend and family on the casualty situation Setting up support zones for care and information exchange and rehabilitation and follow up before the arrival of the casualties and survivals Accommodating emergency relief officers and members of government agencies and NGOs' in providing their support to the scheme Ensure smooth transition from aircraft to different support areas Ensure there are enough officer to deal with the situation Providing medical support and food to those who need it most Providing cancelling to those who survived the incident and their relatives, also helping them to adjust to the situation Clear lines of communication and coordination is vital for success	Key measure of success – the effectiveness and efficiency of handling and resolving the incident in such a manner that everything returns to normal with minimal destruction within the shortest possible time	Target – to reduce the occurrence of such incident as much as possible and if it does occur there will be measures in place to handle the situation

(*continued*)

KPI	Priorities	Measures of success	Target
[b] Attack on airport facilities or installations [b] Destructive or criminal behaviour by passenger on board aircraft	Priority – the speed with which the services provided by that facility returns and this will be facilitated by: Availability of backup or alternative for the facility The easy of repair or replacement The experience and expertise available The strength and dept of the workforce	Key measure of success – the time it takes to resume normal service after the incidences	Eliminate the occurrence by making sure every facility is protected and under 24 hours surveillance CCTV can be very helpful and physical patrols
Destructive or criminal behaviour directed at cargo on board aircraft	Priority – the easy with which the incident is dealt with and this will be facilitated by: The speed at which the security authority take control of the situation The way and manner the airport officials handle the situation The early arrival of help from ambulances and medical crew Creation of support and cancelling areas for those involved Clear communication to everybody on the situation at hand through the public address system Early support service from special branch	Key measure of success – the time it takes for normal service to begin	Eliminate incidence under the control of the authorities and put in motion robust measure to ease the effect of those out side the control of the authorities

Notes: [a] Evacuation in case of emergency in A, B and C are the same in this table; [b] Will follow the same pattern

Table I.

Evacuation in cases of emergency. During evacuation the airport is closed down (depending on the threat, e.g. fire, bomb, terrorist) the speed of evacuation is important, there will be loss of revenue and failure of businesses; we do not want that to happen so all effort is directed towards reopening the airport. Achieving this can be facilitated by:

- clear communication through the public address system;
- clear signage to the nearest assembly point; and
- unobstructed route to the nearest assembly point.

The efficiency and effectiveness of the security officers in responding to the incidence.

Hysteria control. An Air bus Jet A320 crashed into the French mountains on Monday the 20th January 2006 at about 1945 local time. Air inter flight IT5148 from Lyon to Strasbourg vanished from radar and radio contact. It was seven minutes from Strasbourg airport. Five hours later rescue teams arrived at the crash site on mount Sainte-odile (2,500 feet). Of the 90 passengers and six crew members, nine survived and 87 died, how do we take care of friends and relations of those on board that very flight? How do we communicate the situation to the various publics and how do we handle the entire situation? What will be our priorities? What will be our key measure of success? What should be our target?

The speed of getting things under control is important here and this will be enhanced by:

- effective communication to friend and family on the casualty situation;
- setting up support zones for care and information exchange and rehabilitation and follow up before the arrival of the casualties and survivals;
- accommodating emergency relief officers and members of government agencies and NGOs' in providing their support to the scheme;
- ensure smooth transition from aircraft to different support areas;
- ensure there are enough officer to deal with the situation;
- providing medical support and food to those who need it most;
- providing counsel to those who survived the incident and their relatives, also helping them to cope to the situation; and
- clear lines of communication and coordination is vital for success.

Attack on airport facilities or installation. Depending on the facility in question, and how important it is to the operations of the airport. If there are back up to the facility, such that there is minimal destruction to the service provided. Priority is the speed with which the services provided by that facility returns and this will be facilitated by:

- availability of backup or alternative for the facility;
- the easy of repair or replacement;
- the experience and expertise available; and
- the strength and dept of the workforce.

Eliminate the occurrence by making sure every facility is protected and under 24 hours surveillance CCTV can be very helpful and physical patrols.

Destructive or criminal behaviour.

- By passenger on board aircraft.
- Directed at cargo on board aircraft.

The use of a device, substance or weapon to carry out act of violence against a person at the airport or directed at a cargo on board aircraft. Depending on where the incidences occur whether it is airside or landside chances are that it will is landside because it is almost impossible to carry a weapon through security to the airside and the nature of device or weapon used. The Police are better at handling cases of violence and use of weapon. The ease with which the incident is dealt with and this will be facilitated by:

- the speed at which the security authority take control of the situation;
- the way and manner the airport officials handle the situation;
- the early arrival of help from ambulances and medical crew;
- creation of support and cancelling areas for those involved; and
- clear communication to everybody on the situation at hand through the public address system.

Conclusion

The purpose of this paper was to outline the initial results from a research study seeking to develop and test a set of key performance indicators for airport safety and security. In the process of attaining this purpose, affirm the role of FM in improving the facilities at the airport. Airport safety and security is all about risk management. Performance measurement is not an easy task, especially when relating it to FM functions. There is the need to develop indicators because FM functions are not measurable, these indicators we now help in assessing the performance in the areas of safety and security. So far the initial pilot survey, interviews and questionnaires have been administered and results presented. A further report will complete the process of developing the KPIs for airport safety and security, in that report the methodology employed in arriving at the final KPI list will be presented and the process of validation and testing for implementation. For now, it is sufficient to say that, intelligence and information sharing is vital in combating acts of terrorism and crimes at the airport, The UK government is already doing a lot through the DFT in the areas of national threat assessment. These is an on going and continuous exercise with clear scope for improvement; with the aid of rigorous benchmarks, KPIs, measurement and performance targets. The next stage of this research will be to further develop, test and validate the potential KPIs through workshops and more detailed case study investigations.

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