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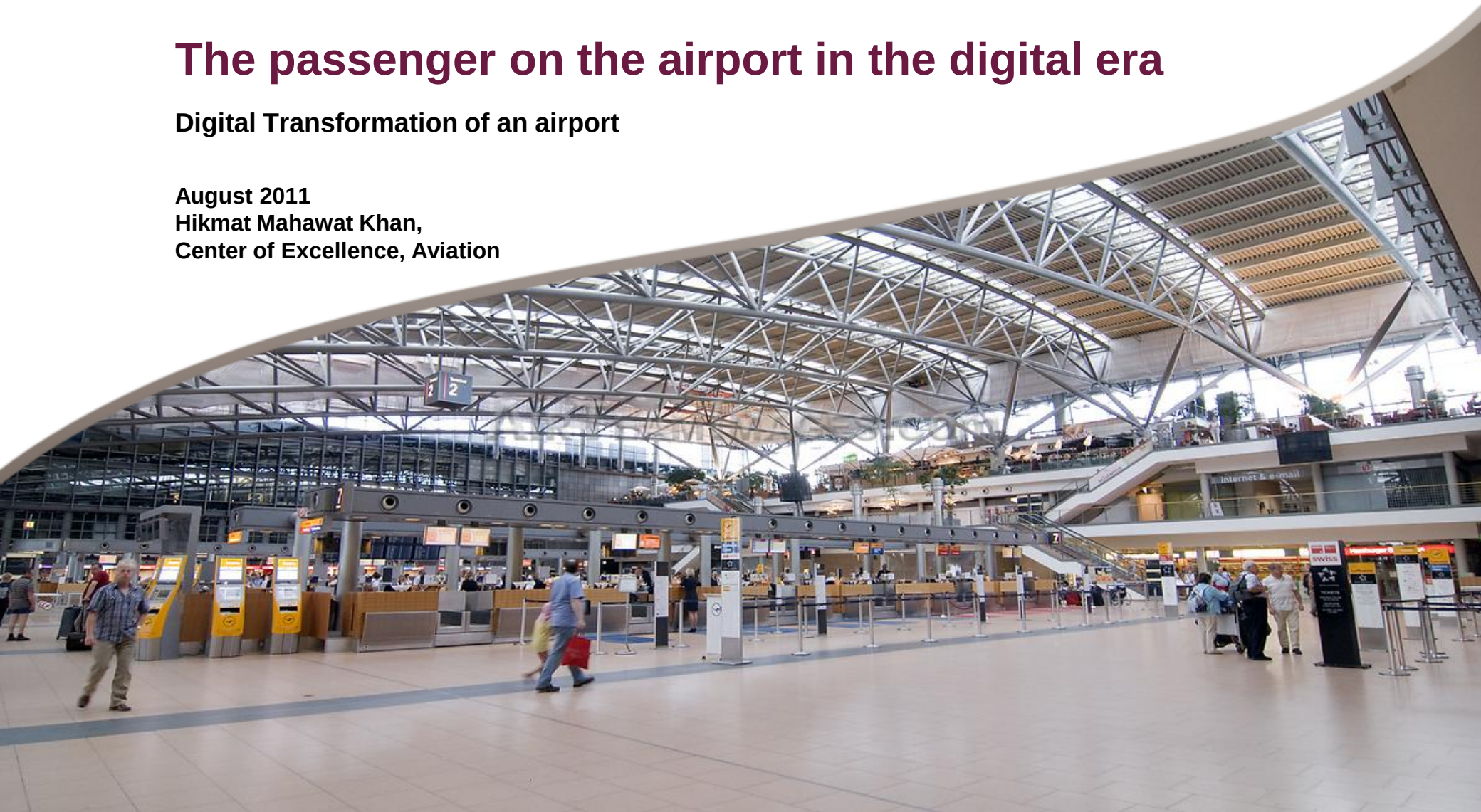
The passenger on the airport in the digital era

Digital Transformation of an airport

August 2011
Hikmat Mahawat Khan,
Center of Excellence, Aviation



- Objective and Scope
- Airport – Business Overview
- Key Industry Challenges
  - Seamless Passenger Journey
  - Revenue Generation
- Technology Solutions for
  - Seamless Passenger Journey
  - Revenue Generation
- Technology Landscape
- Transformation of Legacy Airport
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Background, Objective and Scope

Background:

- Improving passenger satisfaction remains the key business imperative for an airport
- Airport are facing very thin margins – revenue from airlines is not sufficient to cover the entire operating cost. Therefore focus on generating non-aeronautical revenue is gaining momentum
- A set of digital tools & technologies are being used at an airport to smoothen the airport operations while improving passengers satisfaction and revenue of an airport
- Various systems and technology at an airport have mostly evolved over the time; Rethinking and setting the future state in a coordinate way is where Digital Transformation will help

Objectives -

- To highlight the challenges faced by airport industry
- To understand the digital technological solutions for providing seamless passenger services and improving non-aeronautical revenue

Scope

In Scope	This study will cover the following areas: ▪ Key Challenges *Slide: 11 – 12* ▪ Focus on role of New Digital Technology for Seamless on Passenger Journey and Revenue Generation *Slide: 14 – 21* ▪ Technology Landscape *Slide: 23 – 24* ▪ Transformation of Legacy Airports *Slide: 26 – 27*
Out of scope	▪ Area related to improving the "operational efficiency" of an airport through digital technologies ▪ Collaboration between Airport, Airlines, Public services(including ATM)

Sources: CPRDT Lab Analysis.

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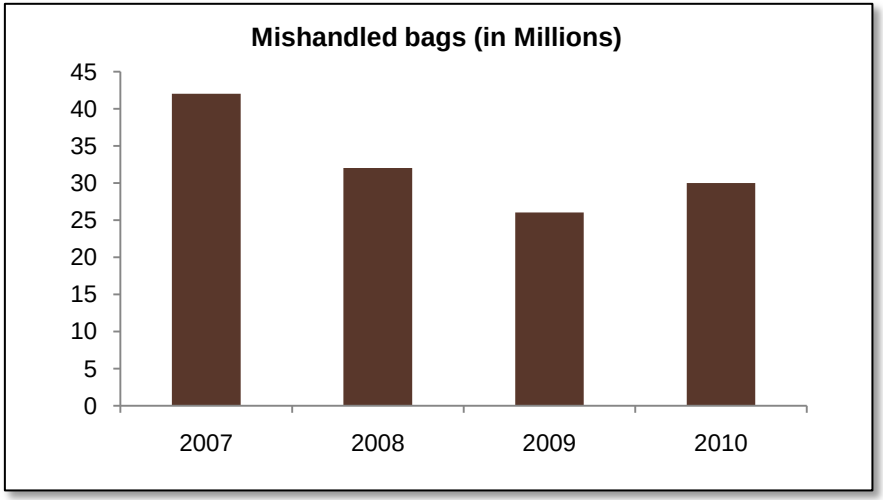
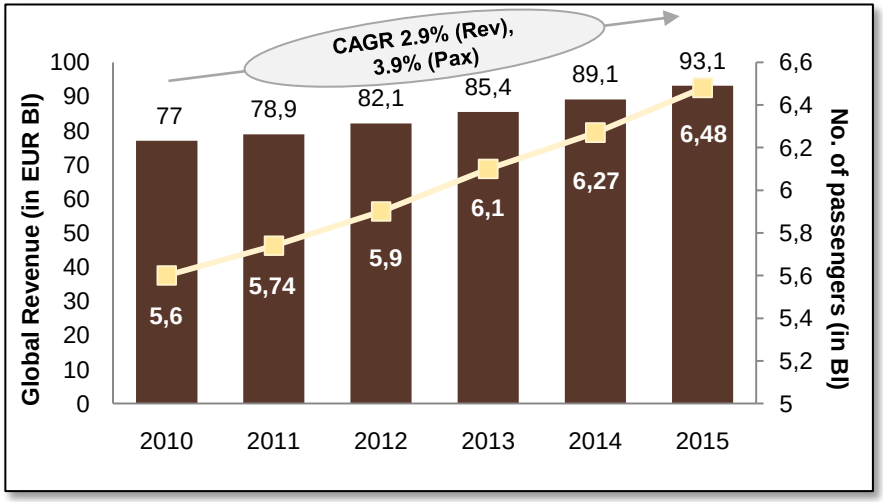
Airports foresee a constant upsurge in the number of passengers as well as revenue and are faced with increasing level of passenger expectations

Airport – Business overview





Key Highlights

- The economic crisis led to a significant restructuring at an airport with a paradigm shift from infrastructure provider to a service provider – new focus is on improving passenger satisfaction and revenue generation
- Three key issues having the most severe impact on passenger travel experience are **baggage issues**, disruption management (delayed or cancelled flights), and check-in time delays
- Airports are now faced with the escalating expectations of passengers, who are accustomed to sophisticated, fast-changing technology environments at home and at work
- Airports today also face critical efficiency issues due to disparate mishmash of technology and systems which is less than ideal when it comes to managing passenger flows, maximizing the passenger's dwell time and ensuring quick turnaround
- The forecasted growth in number of passengers overshadowing the growth in revenue (2010-2015) may imply a declining passenger experience in an airport

Sources: CPRDT Lab Analysis; Datamonitor – "Global Airport Services Industry profile", April 2011; content.yudu.com; JD Power's "Global Airline Traveler Survey", 2010.

Airports are transitioning from infrastructure providers to service providers with focus on enhancing passenger services and revenue generation

Key Trends

To provide Seamless Passenger services

- Airports are investing in technological solutions for real time information sharing and enhanced resource utilization
- Airports are now allowing passengers to take control over their journey cycle, through technology, such as using mobile phones to navigate through the airport processes from check-in to boarding, from bag drop to shopping

Stanley Hui Hon-chung, ***Chief Executive Officer Airport Authority Hong Kong*** *– "Will continue to go the extra mile for passengers going through HKIA and work hard together, not only to maintain the airport's world-class service, but also to take it to an even higher level"*
Awarded World's Best Airport in 2011

Towards Non aeronautical revenues

- In most of the countries, the aeronautical revenue is regulated by government but the non-aeronautical revenue is market-based which provide ample space for growth
- Airports are becoming "Transportation Hub" and this provides an immense growth opportunity for non-aeronautical revenue stream

John Holland-Kaye, **Heathrow's Commercial Director** – "*Every pound made by us is invested in refurbishing & redeveloping the terminals offering 740,000 square feet of retail space providing the excellent shopping experience we know our passengers expect"*
Best Airport Shopping Award 2011

Move towards collaboration

- Migration of airport industry's focus from function centric mode to operations centric mode puts the emphasis is on creating a seamless travel
- Increased awareness and regulations pressure to bring a collaborative approach of working between different parties involved at an airport to bring order and visibility

Lee Seow Hiang, **Chief Executive Officer CAG**, - "The progress made in the last three decades is the result of the steadfast support and close-knit partnership shared by airlines, government agencies, ground-handling agencies & other companies at the airport"
Best International Transit Airport 2011

Sources: CPRDT Lab Analysis; Cisco.com, " Transforming Passenger Experience To Thrive in the New Economy", 2009; Sita.com, "Baggage Report 2011",2011; Eurocontrol.int.

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Airports are faced with inefficient use of infrastructure, declining passenger satisfaction and diminishing aeronautical revenue

Challenges for an Airport

Passenger Oriented Challenges

(In Scope)

PASSENGER CHALLENGES	REVENUE CHALLENGES
▪ Providing seamless travel across each step of the customer touch points ▪ Meeting passenger expectations and improving their experience across the customer journey ▪ Coordination and organizational challenges due to growth in passenger volumes	▪ Declining aeronautical revenue and need to improve non-aeronautical revenue ▪ Stimulating passenger demand for non-aeronautical products/ services ▪ Less predictable demand for facilities and revenue streams

Airport Operations Oriented Challenges

(Out of scope)

OPERATIONAL CHALLENGES
▪ Lack of ability to track, manage and share real-time information to manage airport processes and quicken decision-making for all stakeholders ▪ Lack of ability to manage the flow of aircraft, passengers and goods arriving and departing from an airport ▪ Outsourcing of services, such as ground operations, to third party providers has complicated the collaboration among parties

Sources: CPRDT Lab Analysis.

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Meeting passenger expectations and improving the experience across the passenger journey is a key challenge faced by an airport

Passenger Challenges

1
- Which route, airport, services and airline do I choose?
- How is the traffic on the way?
- Will I be able to get a suitable parking place at the airport?

2
- Am I on time? Do I need special services?
- Which transport options do I choose?
- What do I do as a result of delay or cancellation?
- Where do I go next?

4
- How to get information on surrounding hotels and city attractions, city weather, events etc?
- How do I get to my destination? Which all options are available outside airport to reach the destination in the shortest time?

3
- Where do I get the information about check-in?
- Is there any possibility for self check-in through several channels?
- How to reach the boarding area? Or navigate in a big airport?
- Where can I go to get the best retail or hospitality options in the airport?
- Is there Wi-Fi connectivity available?

- Where are my bags?
- Do I need to register for lost bags?
- Where is duty free or retail area located?
- What offers or where can I get the best retail options in the airport?

Technology acts as an enabler to help airports resolve these challenges while enhancing passenger experience which eventually boost non-aeronautical revenue.

Sources: CPRDT Lab Analysis.

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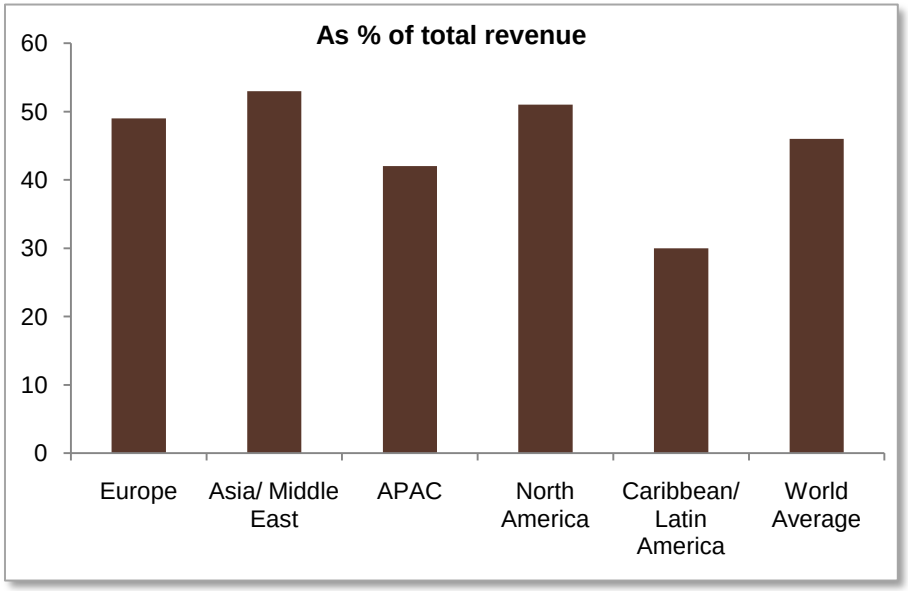
Airports have been struggling to maintain their financial viability in light of falling aeronautical revenues

Revenue Challenges

Aeronautical related revenues, which have traditionally been the main revenue source of airports, have come under significant pressure in the face of market liberalization, has led to:

- Increased competition between airlines which is driving lower airfares mandates airlines to operate on limited margins wherein regulated aviation charges remained stagnant
- Privatization of airports and a steady decline in state control and funding



- In 2009, worldwide total airport income reached USD 95 billion, in which USD 44 Billion (approx 46%) came from non-aeronautical streams – ACI, Airport Economics Survey 2010
- Non-aeronautical revenues critically determine the financial viability of an airport as they tend to generate higher profit margins than aeronautical activities, which are typically cost-recovery only or operate at a deficit
- With an integrated value chain airports and airlines can up-sell and cross-sell to the passenger, providing personalized services that increase revenues, customer satisfaction and wallet share
- Airports are expected to loose close to $28 billion in retail spend by 2012, due to lack of right customer knowledge – Blackstone Gates

The steady decline in aeronautical revenue has amplified the pressure on airports to identify and improve non-aeronautical revenue sources to remain profitable.

Sources: CPRDT Lab Analysis; airports.org; cisco.com; userpage.fu-berlin.de; Airport Council International, New Release - ACI Airport Economics Survey 2010.

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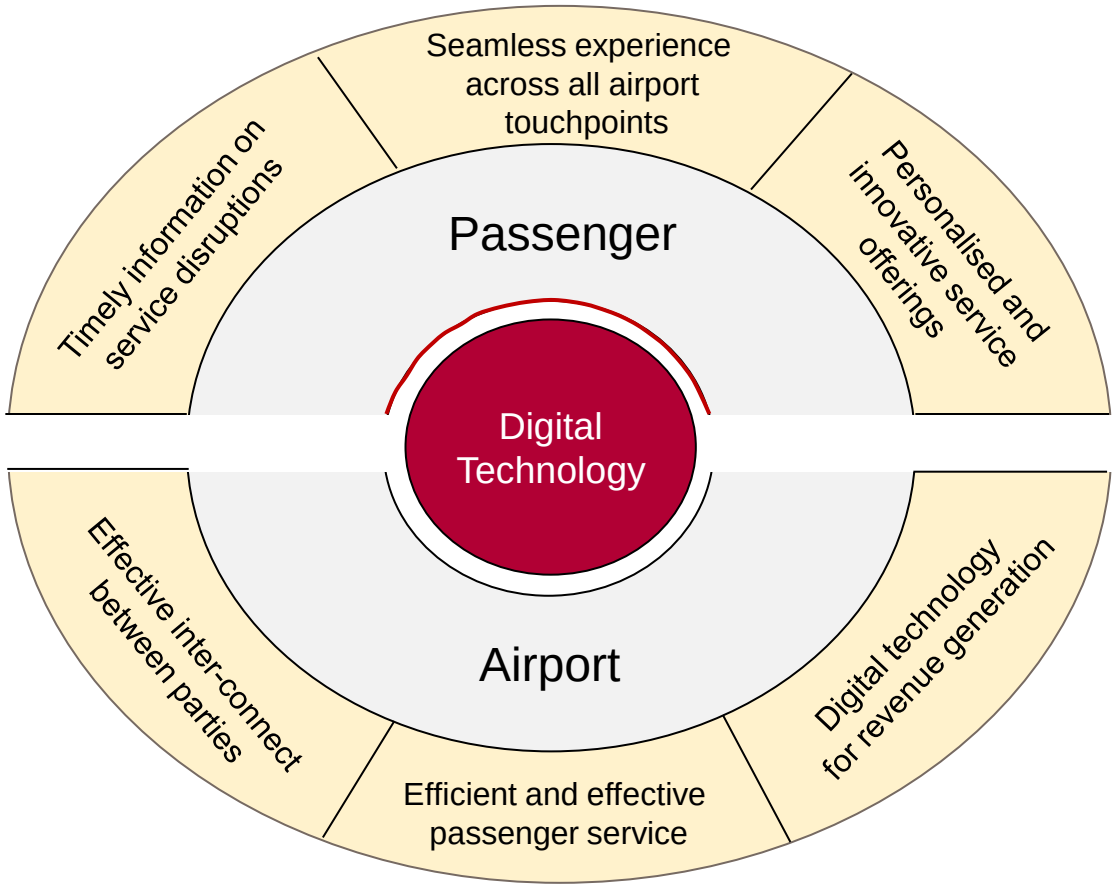
Passenger expectations and airport business imperatives are intersecting with consistently increasing adoption of digital tools and technologies

Digital Technology – Meeting airport and passenger challenges



- Self-service solutions like CUSS have enabled common use of airport facilities through shared kiosks and allowing passenger flow management in airport
- Mobile phones are continuously evolving, from being just a passenger communication channel, to interaction / transaction driven interface for the passenger
- Comprehensive mobile social media strategies are being adopted to increase revenue-producing opportunities and enhance customer engagement

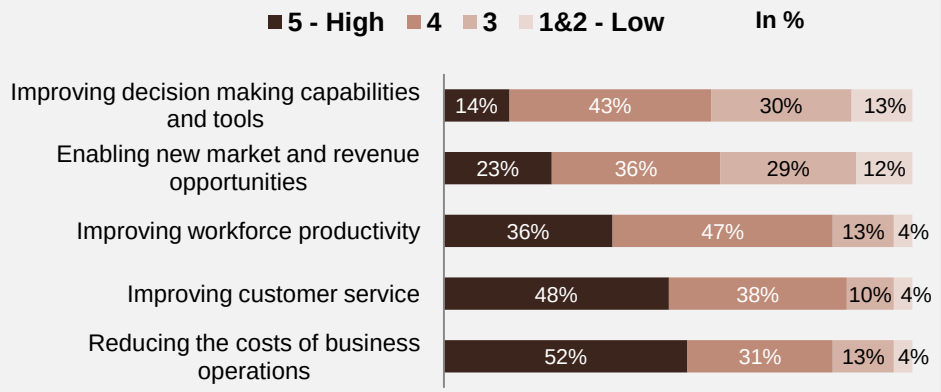
- Digital solutions are used to build a unified interconnect between all parties to improve information sharing in order to take critical decisions for smooth airport operations
- Helps in the realization of strategic gains for an airport's effectiveness, efficiency and agility

Sources: CPRDT Lab Analysis; SITA, "The Airline IT Trends Survey", 2010; SITA, "Air transport world passenger self-service survey",2010; JD Power/Amadeus, "Global Airline Traveler Survey", 2010.

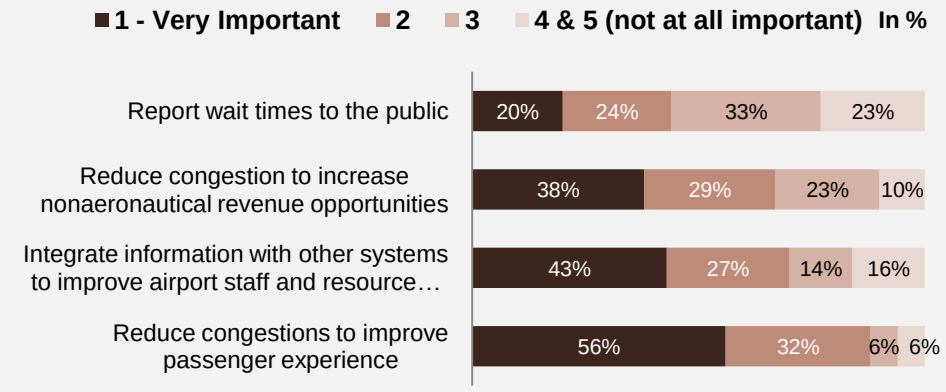
The new age digital technologies are being rapidly adopted by airports, across the globe, to overcome the challenges and improve their service offerings

Technology Adoption Trends

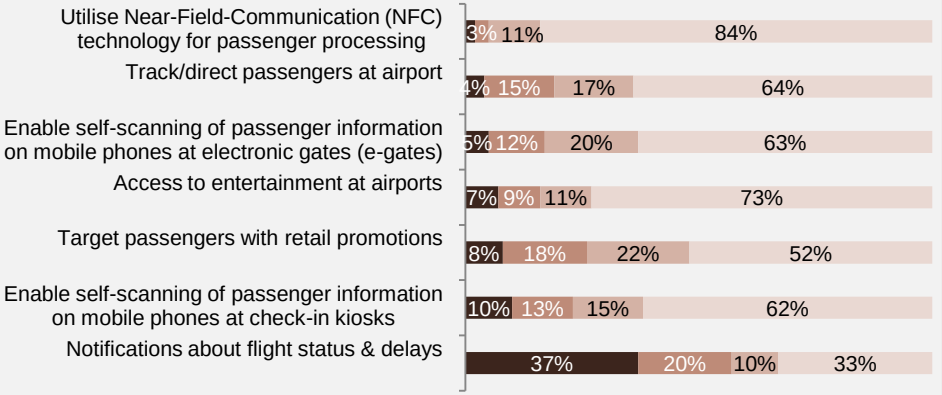
IT Investment Priorities – Key drivers



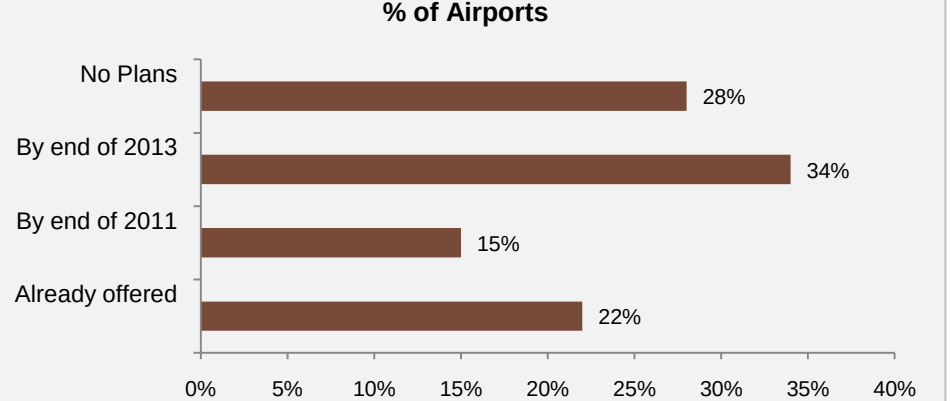
Motivation for Passenger Flow Monitoring Solutions



Mobile-based Services for Passengers



Self-service as Primary Channel for Passenger Check-in



Sources: CPRDT Lab Analysis; SITA - The Airport IT Trends Survey 2010; 2010 JD Power's 'Global Airline Traveler Survey.

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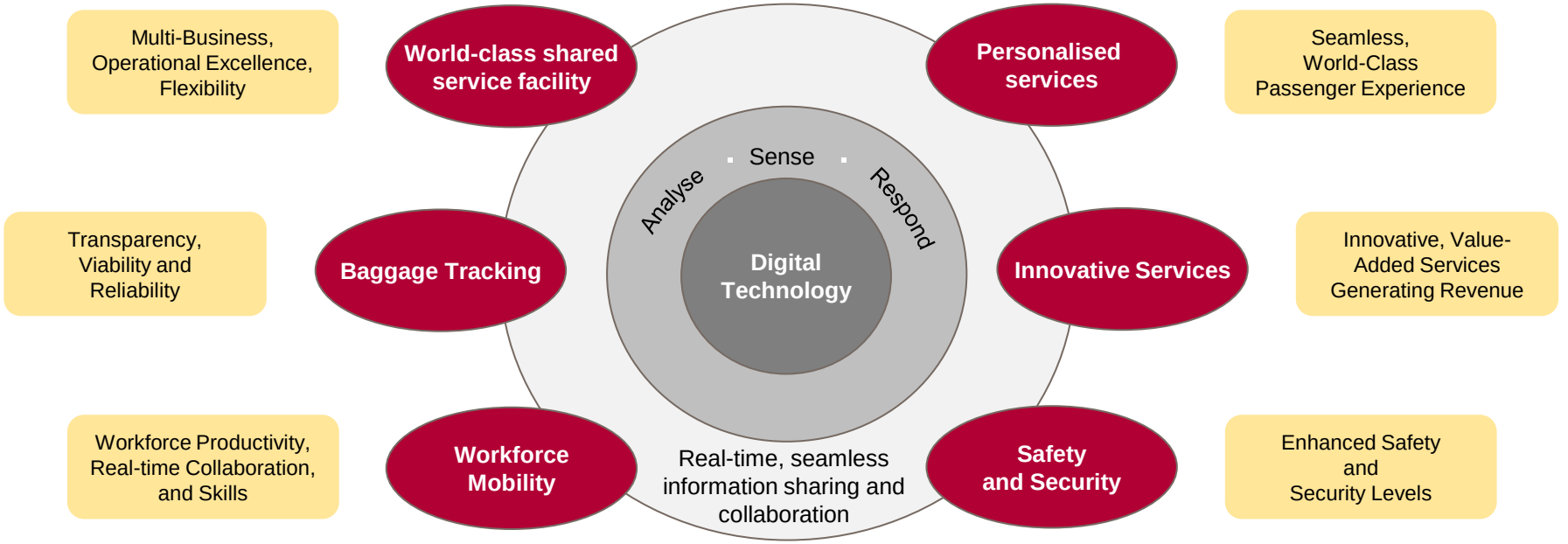
Digital technologies act as the airport's nervous system, touching and managing every point of interaction

Digital Solutions at Airport

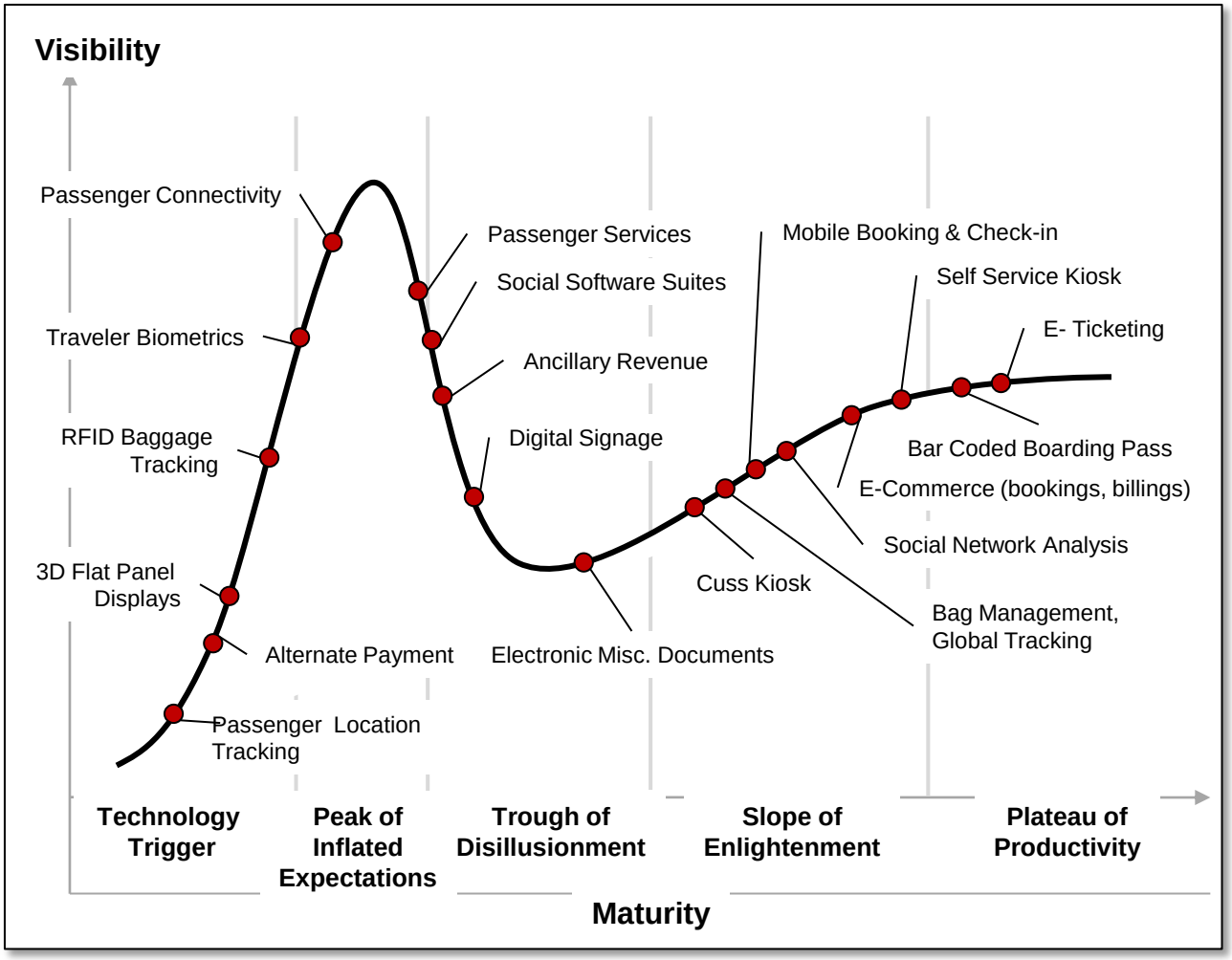


- Enhance passenger experience by delivering a range of personalized services enabled by seamless exchange of passenger data to anticipate needed services
- Enable the exchange of real-time information, deep cross-silo collaboration, and airport-wide process integration, smart airports significantly improve operational efficiencies, passenger services, and advanced security capabilities
- Help to reduce time constraint and increase passenger's ability to make purchases at airports and boost non-aeronautical revenue
- Exploit the power of emerging and maturing technologies, with advanced and pervasively deployed sense-analyze-respond capabilities

Sources: CPRDT Lab Analysis; Cisco Smart Airport POV.

Digital technologies used at airports are at different levels of maturity wherein social media, baggage tracking and self-service kiosks are gaining momentum

Gartner – The Air Travel Industry Hype Cycle, 2010



- The implementation of digital technologies is changing IT management disciplines in response to the combination of IT, operational technology (OT), product-embedded technology, and consumer and personal technology
- Usage of mobile phone for boarding pass is currently being utilized in domestic travel, stricter requirements in cross border travel limits the use of mobile phone boarding
- Mobile ticketing facilitates cost reductions and also enhances passenger convenience while reducing environment footprint
- Web2.0 (Social Media) is being used to increase loyalty and for customer retention which provides a push to ancillary revenue in competitive airport market
- The intelligent, secure and interactive aspect of NFC technology is helping to grow its usage as e-wallet, alternate payment and to improve passenger flow

Sources: CPRDT Lab Analysis; Gartner – Air Travel Industry Hype Cycle (2010); SITA - The Airport IT Trends Survey 2010.

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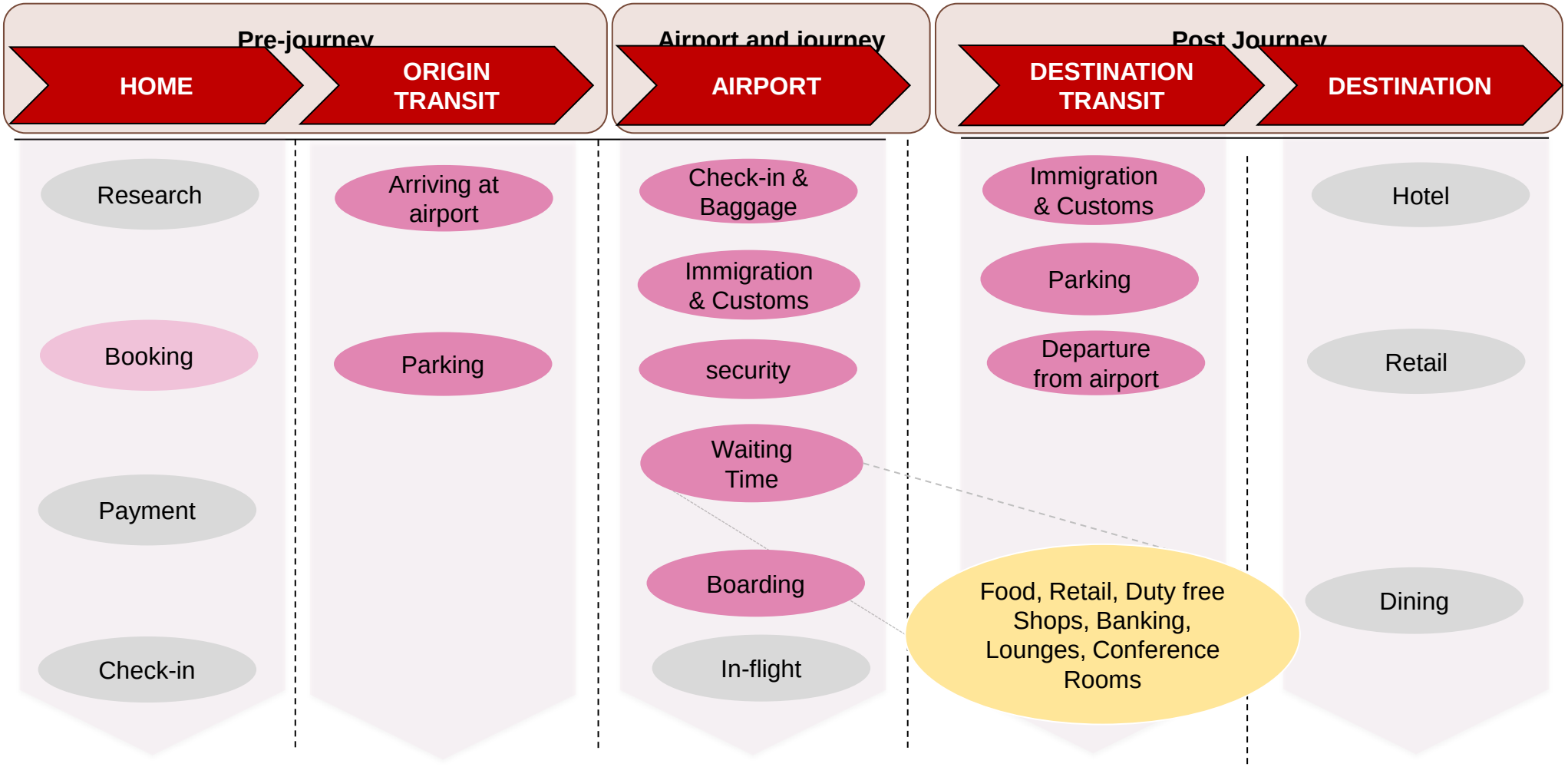
Key touch points in Passenger Experience Journey



Sources: CPRDT Lab Analysis.

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A plethora of digital technologies are being leveraged to enhance the passenger experience at various touch points across the journey

Pre-journey

- **Real-time travel services**
  - Offer premium services such as valet parking and route switching, if passenger is at the risk of being late
  - Intelligent transport services can track a traveller via a GPS-enabled Smartphone and provide pre-trip travel information and flight status
  - Use of Social Media for sending out real time updates on departure/ arrival status of flights or any other updates
- **Remote Check-in**
  - Remote check-in from office/ home
- **NFC/ RFID/ Precision Parking Technology for parking**
  - To helps passenger to find empty parking slots and also guide vehicles in parking
  - RFID technology based smart cards like E-Z pass to make payment for airport parking

Heathrow | Berlin Airports | Melbourne International Airport | Gatwick

Airport and journey

- **Virtual Assistants**
  - Share important relevant information with passenger as they progress from check-in to departure
- **Smartphone/ Mobile based**
  - Provides details and flight status of all trip stages on a Smart phone or a kiosk
  - Accessed through mobile to be used as e-boarding pass
- **Location based services**
  - Direct people through the airport to reduce stress, minimize queues and increase retail sales
  - Offers provided on passengers mobile phone based on customer information gathered at airport
- **Biometrics - BioThenticate**
  - Uses fingerprint recognition or iris scanning for seamless passenger flow and security
- **Wi-Fi/ Bluetooth Tracking** of passengers

Frankfurt Airport | London Luton Airport | Munich Airport | Malaysia Airports | bahrain International Airport

- **Video analytics**
  - Helps in tracking and in analyzing passenger movements patterns across airport
- **RFID Check-in**
  - RFID-tagged boarding passes or mobile, smart-code enabled phones for check-in
  - Remote bag drop facility
- **RFID baggage tagging**
  - Make it easier to find misplaced or missing bags and provide up-to-date location information to passengers
- **QR codes**
  - downloaded by passengers on their smart phones, receiving discount coupons from airport side retailers
- **Social media microsite**
  - offers personalized communication, by understanding specific needs of its various customer segments

Sydney Airport | Schiphol Amsterdam Airport | Copenhagen Airports CPH | Melbourne Airport

Post-journey

- **Self service car finder kiosk**
  - Help passengers in identifying the location of a parked car
- **Smart phones Apps**
  - Using GPS technology to locate a parked car in airport
- **Real-time travel services**
  - Guide travelers through the airport whilst also providing information about surrounding hotels and city attractions, plus live feeds of city weather, events happening etc.

ZNZ | Hong Kong International Airport | DFW Dallas/Fort Worth International Airport

Sources: CPRDT Lab Analysis.

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A plethora of digital technologies are being leveraged to boost the non-aeronautical revenue on airport

Retail & Hospitality

- **Digital Media Download Kiosks –** provides access to entertainment options and enables the purchase and download of movies, music, games etc.

- **Digital interactive displays -** including 3D, interactive dressing room mirrors, kiosks with virtual customer-service representatives and digital scanners that offer personalized discounts

- **Smartphone Application –** can be used as a channel for one-to-one marketing and providing real-time information
- **Interactive Mylar screens –** helps to provide passenger specific retail and hospitality offers on their mobile phone based on customer information gathered by the airport

- **Self Serve Order and Pay** – helps to place orders and pay for food without staff assistance

- **WorldPoint Cards –** can be exchanged for rewards including airport shopping vouchers, discounts on car parking and express bookings

Heathrow Official airport website

SFO

QANTAS

John F. Kennedy INTERNATIONAL AIRPORT

Advertising, Property, Parking and Other

- **Digital signage poster systems/ Video walls –** provides revenue generation opportunities through additional advertisement space

- **Augmented reality –** uses camera, along with overlaid information, to present location data while looking at the “real world“; The Yelp iPhone app, Monocle

- **Mobile devices as personal travel folders/e-wallets-** helps travelers to pay for everything from excess baggage to airport taxes and duty free shopping

- **VC Conferences -** offer high-end, life-size virtual conferencing enabling “face-to-face” business meetings around the world making airport as temporary office for business class

CHICAGO CDA DEPARTMENT OF AVIATION

O·R·TAMBO INTERNATIONAL AIRPORT

Copenhagen Airports CPH

Sydney Airport

Albany International Airport

Sources: CPRDT Lab Analysis.

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The adoption of diverse digital technologies creates the risks of diminished enterprise synergy due to growing vendor landscape

Digital Technology Risks

Business Risks

- Inability to connect or integrate multiple digital technologies acquired from different technology vendors by different business owners
- Lack of clear governance processes from the top down, especially that engage stakeholders and communicate the opportunities for integration of information, business processes and digital technologies
- IT organization lacking the credibility and skills to contribute beyond the traditional IT role
- Lack of defined framework to assess the return on investment
- Inability to find, engage and refresh talented people for managing diverse digital and IT platform
- Sharing information while simultaneously complying with regulation, for example CAA (Civil Aviation Authority) in UK
- Inability of organization to reacting to disruptive new business models

Implementation Risks

- Lack of clarity in defining the connection of the information, processes and relationships across functional silos
- Inconsistent decision-making processes between parts of the business supported by different technology silos
- Inability to restructure the IT organization while adding OT professionals and perhaps others, including product-embedded technology professionals, if appropriate
- Lack of focus on managing workforce transformation and change management
- Lack of clearly defined roles and responsibilities for business process owners
- Inability to share expertise across the multi-disciplinary global workforce
- Technology is often locally deployed which impacts the airport's ability to execute common processes across airlines and terminals, and also does not allow airports to share best practices by using a common platform

The realization of the benefits to business process improvement is difficult in organizations with fragmented, cross-silo process ownership and disconnected digital technology implementations.

Sources: CPRDT Lab Analysis; Gartner.com

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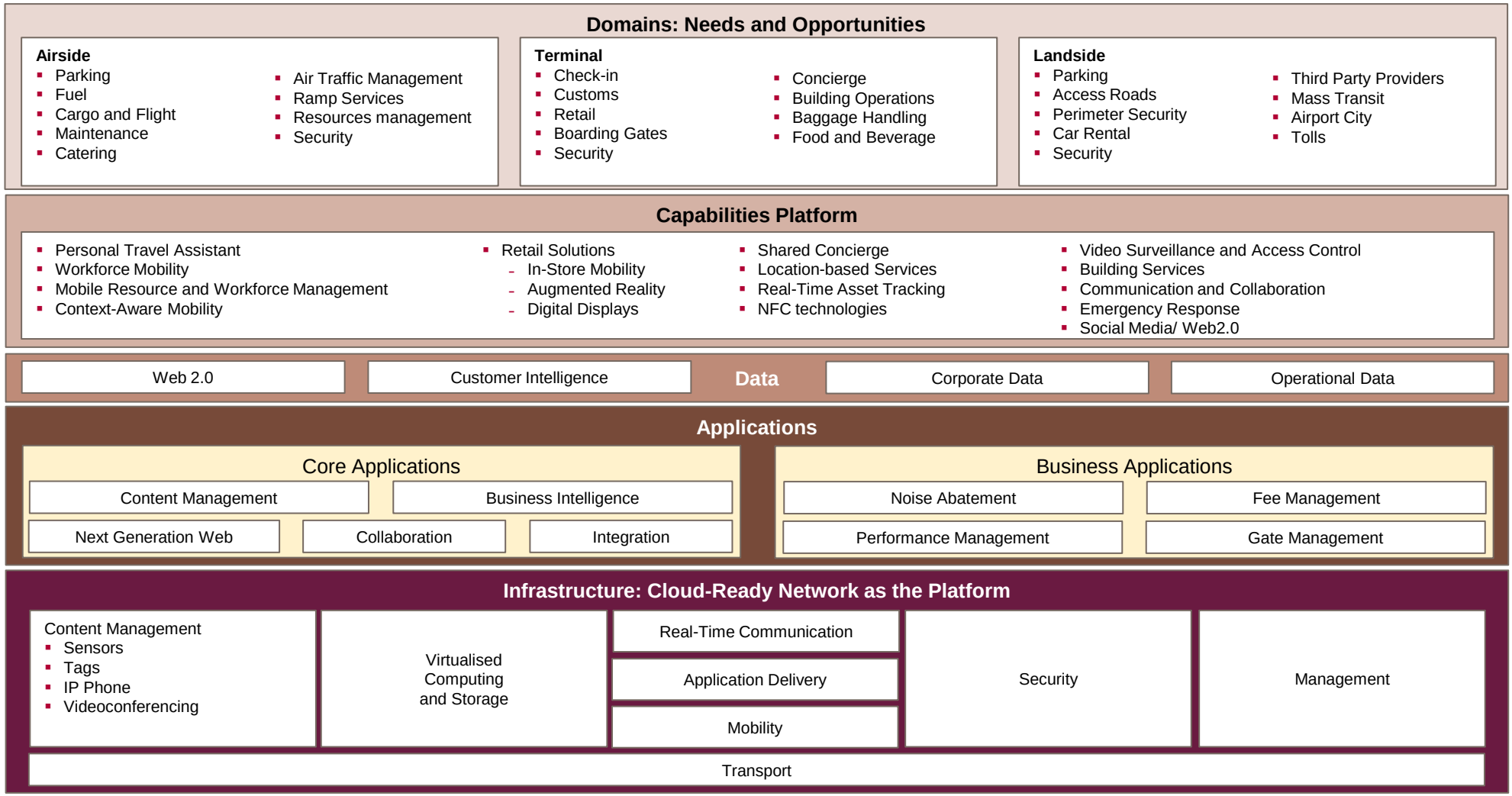
Services supporting efficient airport operations and the end-to-end passenger journey experience require an end-to-end airport architecture

Technology Landscape and Architecture



Sources: CPRDT Lab Analysis; Cisco Smart Airport POV.

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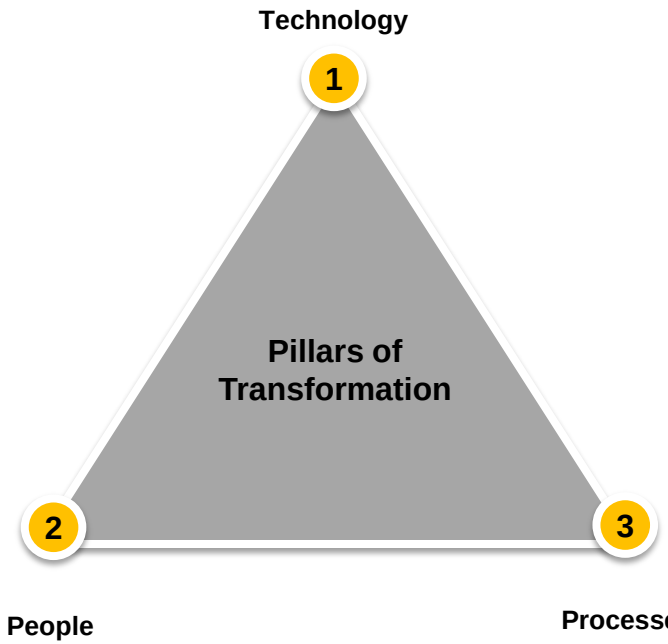
Digital technologies can be a means to revisit the way business is conducted and introduce substantially more efficient processes and workflows

Imperatives for Digital Transformation



Digital Transformation is the increasing adoption of digital tools and processes within all aspects of an organization

- Digital transformation is focused on enhancing productivity through people leveraging new tools and effective change management to create long lasting results
- Focus on how digital technologies drives business transformation, rather than on implementing technology point solutions to solve functional problems

1

Digital Technology

- Promote all digital technologies and associated information while integrating them with business processes
- Use integrated framework of three most-critical business assets: processes, information and technology
- Bridge disconnects between multitude of digital technology by integrating them through uniform information strategies

2

People – Organization

- Mandate the realignment of IT department's roles and relationships to maximize the value of converging IT and Operational Technologies
- The IT organization's role transforms from IT delivery organization to managing the exploitation of the business assets of processes, information and relationships across all technologies in the enterprise

3

Processes – Clear governance of technologies

- Devise clear governance processes from the top down that engage stakeholders and communicate the opportunities for the integration of information, business processes and digital technologies
- Focus on the business outcomes that emerge from governance relating to improved efficiency and effectiveness of business processes, and delivery of the information needed to facilitate effective decisions

Sources: CPRDT Lab Analysis; Gartner.com

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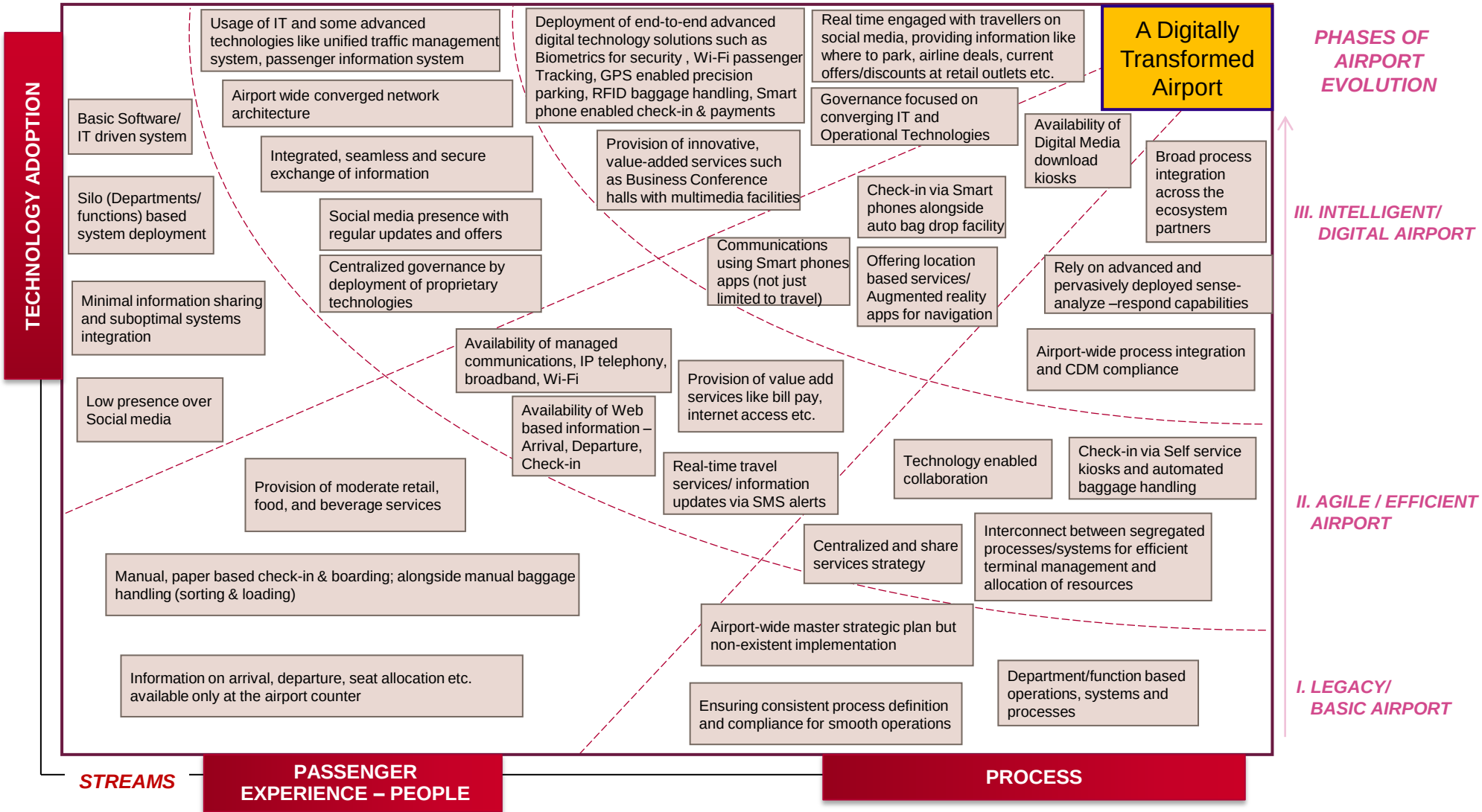
Transformation of legacy airport to an 'Intelligent Airport' needs a multi pronged approach encompassing investment in digital technologies

Transformation Map



Note: CDM – Collaborative Decision Making

Sources: CPRDT Lab Analysis.

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Conclusion

- *Airports are transitioning from infrastructure providers to service providers with focus on enhancing passenger services and revenue generation*
- *A plethora of digital technologies are being leveraged to enhance the passenger experience at various touch points across the journey and to boost the non-aeronautical revenue on airport*
- *Digital technologies used at airports are at different levels of maturity wherein social media, baggage tracking and self-service kiosks are gaining momentum*
- *Services supporting efficient airport operations and the end-to-end passenger journey experience require an end-to-end airport architecture*
- *Digital technologies can be a means to revisit the way business is conducted and introduce substantially more efficient processes and workflows*

Transformation of legacy airport to an 'Intelligent Airport' mandates investment in digital technologies, improved operational and passenger processes along with realignment of organization functions.

Sources: CPRDT Lab Analysis.

Capgemini Consulting

Contact details

Hikmat Mahawat Khan MSc MBA

Principal Consultant

Center of Excellence Aviation

Capgemini Nederland B.V.
Papendorpseweg 100 – P.O. Box 2575
3500 GN Utrecht – The Netherlands
Tel. + 31 30 689 0000
Mob. +31 6 15030946
hikmat.mahawatkhan@capgemini.com
www.capgemini.com

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Passenger Experience - Social Media at Airport

Airports need to actively exploit social media tools to offer enriching experience to its passengers

	Functions of Social media		
Airport	Customer Engagement	With Social media, airports can now attract and engage passengers, with benefit of two-way conversations that enable easy sentiment-tracking and real-time feedback analysis, rather than one-way broadcasts	Bangalore international airport (India) launched social media campaign in 2010, to encourage passengers to post ideas, feedback on its expanded terminal 
	Revenue Generation	Social media is a critical touch point for an airport when it wants to focus on strategies that generate value for its passengers, with an aim of increasing revenues	Malaysia's KLIA airport launched social media campaign - iStyleKLIA 2010, to promote the airport as a lifestyle destination 
	Customer service delivery	Sound social media strategy aids airports in recognizing the disconnect between passenger expectations and to discover opportunities for effective service delivery to passengers	London's Gatwick Airport has a twitter screen in full public view, allowing passengers to tweet any issues that require attention 
Customer	Access to Information	Passengers are smartly leveraging the power of social media by sharing real time updates on traffic, flights and airports; and also contribute by giving review on experience at an airport	Melbourne International Airport through its twitter page help customers by providing information about airfare bargains 
	Personalized Service	Airports can take the advantage of social media to have personalized, value – rich conversations that addresses the specific concerns of its passengers	The social media micro site for St Paul international airport , Minneapolis offers personalized communication, by understanding specific needs of its various customer segments 

Sources: CPRDT Lab Analysis; moodireport, "Bengaluru Airport seeks public feedback in major ad campaign" 2010; simplyflying.com; investorspot.com - "Social Media Comes In For A Landing At Airports".

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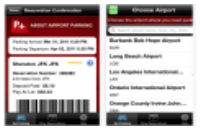
Passenger Journey – Technology Solutions

Pre-arrival technology touch points and their application in experience journey (1/2)

Pre-arrival (Choosing Airport - Ticket booking - Parking)

Touch Points	Technology	Technology Deliverables	Key Adopters
Choosing airport ▪ Information/ Updates	▪ **Smartphone app** which allows passengers to get passenger reviews on airport, hotel and car rental information and receive updates automatically	▪ Improve customer experience ▪ Active passengers database for airport 	DFW DALLAS/FORT WORTH INTERNATIONAL AIRPORT Heathrow
Ticket booking ▪ Prices on various air routes ▪ Best deals on flight	▪ Airports can take **social media** route to share daily deals / promotions on flight route - Melbourne Airport is using Twitter to post flight deals	▪ Real time information for customers ▪ Value added benefits for customer ▪ Additional revenue streams for airport	MLB Melbourne International Airport
Parking pre-booking @ Airport ▪ Online booking ▪ Mobile booking	▪ **Smartphone applications** such as "About Airport Parking" allows passengers to book parking slots at airport, through mobile	▪ Quick and hassle free travel ▪ Efficient parking area management  	Heathrow Berlin Airports LAX Los Angeles World Airports Edinburgh Airport
Arriving at the Airport ▪ Flight status information ▪ Navigational tools ▪ Tratraffic updates ▪ Payment in public transport	▪ **Social media** for sending out real time updates on departure/ arrival status of flights ▪ **GPS based navigational systems** aids passengers in getting directions to Airport ▪ **Smartphone apps** provide real time updates on the traffic condition ▪ **Contactless, RFID and NFC** technology based cards can be used to make payments	▪ Enhancing customer convenience ▪ Quick and hassle free travel to airport ▪ Aids passenger in planning travel time to airport ▪ Rapid transit to airport 	HIA Harrisburg International Airport

Note :- NFC- Near field communications, RFID -Radio-frequency identification

Sources: CPRDT Lab Analysis; airlinesanddestinations.com, "DFW Airport Launches Smart Phone App for Its Passengers", 2009; simpliflying.com, "Top 10 Airports on Social Media – case studies of the airports best at driving engagement", 2011;

Pre-arrival technology touch points and their application in experience journey (2/2)

Pre-arrival (Choosing Airport - Ticket booking - Parking)

Touch Points	Technology	Technology Deliverables	Key Adopters
Car Park at Airport ▪ Parking	▪ **Precision parking** technology helps passenger to find empty parking slots and also guide vehicles in parking ▪ Airports are using **Automatic number plate recognition** (ANPR) to keep a track of vehicles movement/ flow	▪ Enables quick identification and tracking of vehicles ▪ Meets customer demand on vehicle security	TOKYO NARITA, Gatwick, CLE Cleveland Hopkins International Airport
Car Park at Airport ▪ Payments	▪ Smart cards based on **contactless technology** like Octopus card in Hong Kong, allows passenger s to pay for parking ▪ **RFID technology** based cards like E-Z pass, esp. in US , is being used to make payment for airport parking	▪ Reduced waiting time in queues for customer ▪ Reduced processing times for Airport and also in lost revenue collection  	Hong Kong International Airport, CHANGI airport singapore, Newark Liberty International Airport, LaGuardia Airport
Car Park at Airport ▪ Car Find	▪ **Self service car finder kiosk** helps passengers in identifying the location of a parked car ▪ **"Car find app" for smart phones** uses GPS technology to locate a parked car in airport ▪ **Augmented reality** based mobile apps are also gaining acceptance in locating parked cars	▪ Enables quick and easy tracking for passengers ▪ Efficient parking area management	Heathrow

Sources: CPRDT Lab Analysis; parkingworld.com, "Airport Parking Technology Takes Off", 2009; looking4parking.com , "Gatwick Long Stay North Terminal", 2011; hong-kong-travel.org, "Transportation > Octopus Card", e-zpassny.com; kioskmarketplace.com, "London's Heathrow airport helps lost passengers with Car Finder kiosk"; macworld.com, "G-Park for iPhone and iPad", 2010; carfinderapp.com.

A traveler is continuously engaged and guided within the airport through information provided to him via smart app or location based tracking tools(1/5)

Departure (At the Airport - Check-in and Baggage - Security - Waiting time)

Touch Points	Technology	Technology Deliverables	Key Adopters
At the Airport ▪ Passage / way to check-in	▪ **Virtual Assistants** (Holographic announcers) 	▪ Virtual Assistants help to communicate important security messages as passengers pass from check-in to the departure lounge	LONDON LUTON AIRPORT
▪ Guiding passengers around the airport	▪ **Augmented reality application** 	▪ Help passengers by provide information on where they are in the airport, what services are available and how they can find their gate ▪ Makes it easier for passengers to plan their time	Copenhagen Airports CPH
▪ Real real-time passenger tracking and queue management	▪ **Bluetooth passenger tracking** used to track movements throughout the airport infrastructure, including queues, check-in, security and immigration areas etc. 	▪ Real-time tracking of passenger; better understand passenger behavior ▪ Rapid deployment of available resources to deal with long wait times	Heathrow Frankfurt Airport

Sources: CPRDT Lab Analysis; Digitalsignageexpo.net; Allmalaysia.info, Airport-world.com.

Self Check-in through easy to use kiosks and Smartphone offer passengers a seamless flow within an airport (2/5)

Departure (At the Airport - Check-in and Baggage - Security - Waiting time)

Touch Points	Technology	Technology Deliverables	Key Adopters
Check-in & Baggage ▪ Check-in	▪ **Self Check-in kiosks** (E.g. iMUSE - a commonly used technology)  ▪ **Self Boarding** with Smart Card/ Smart phone boarding  Works as a mobile boarding pass at the kiosk (to check a bag), at the checkpoint (to get through security) and at the gate while boarding	▪ Easier access to check in; hassle-free airport access ▪ Allows many airlines to share the same gates and check-in counters through a common workstation, thus maximizing airport operations efficiency ▪ Simplifying the security process and improving the experience for passengers	Malaysia Airports; Hong Kong International Airport; Geneva International Airport; Munich Airport; Heathrow
	▪ **Interactive Advance Passenger Information (iAPI)** – to capture and transmit check-in data, passenger by passenger	▪ Helps in passenger handling through faster check-in and boarding	Airports Company South Africa
▪ Baggage screening	▪ **Q Bag Tag -** form of RFID Baggage Reconciliation System/technology allowing passengers to check-in through a permanent Q bag tags which automatically link flight details to their baggage  ▪ Self service **Auto bag drop**	▪ Reduced check-in times for customers, allowing them to move through the check-in area with speed and ease ▪ Enable customers to 'drop' a tagged bag with speed and ease	Sydney Airport; Melbourne Airport

Sources: CPRDT Lab Analysis; Digitalsignageexpo.net; Allmalaysia.info; Airport-world.com.

New digital technologies like Iris recognition & Wi-Fi tracking have made security checkpoints more efficient and passenger centric (3/5)

Departure (At the Airport - Check-in and Baggage -Security - Waiting time)

Touch Points	Technology	Technology Deliverables	Key Adopters
Security ▪ To provide a reliable, trusted and secure passenger information	▪ **BioThenticate** enables biometric identity management to be integrated into both border management and airport functions such as check-in, bag drop and boarding; in order to allow faster and more secure automated processing 	▪ Enable automated border control for known and trusted travelers (e.g. Privium in the Netherlands; US Registered Traveler Program; UK Iris; United Arab Emirates	**Adisucipto International Airport ,** Indonesia
▪ To avoid 'stop & move' kind of situation at the security check to provide quick movement and customer ease	▪ **Iris on the Move (IOM)** Works by quickly capturing the iris image of a person in motion, combining the advanced security of iris recognition with the speed and convenience of a pass-through system	▪ Keeps lines moving quickly at airports while ensuring the security and ease of use in high-traffic areas ▪ Lower operational cost and improves throughput	Schiphol Amsterdam Airport
▪ To make security checkpoints more efficient	▪ **Wi-Fi Tracking** Users who download this app can also receive information on the shortest security lines, as well as promotions from nearby stores or restaurants 	▪ Helps track passengers' movements ▪ Retailers could also use this to offer promotions to users when they come in their vicinity	Copenhagen Airports CPH
▪ Real time passenger tracking	▪ **Video analytics** can help in tracking and in analyzing passenger movements patterns across airport, especially in waiting areas ▪ **Real time location system** based on **RFID** technology is being used to track passenger movement in Airports	▪ Improved safety, security and customer service ▪ Increased manpower efficiency	KLIA Abu Dhabi International Airport مطار أبوظبي الدولي

Sources: CPRDT Lab Analysis; Switched.com; Motorola.com; Secprodonline.com; Airport-world.com.

Interactive communication systems and promotions are offering value add to travelers waiting time, simulating a new airport experience (4/5)

Departure (At the Airport - Check-in and Baggage - Security - Waiting time)

Touch Points	Technology	Technology Deliverables	Key Adopters
Waiting Time ▪ Passenger waiting for boarding while there is no value add/ use to the time available ▪ Utilize wait time for passengers, inciting them to various shopping/ entertainment options	▪ **Smart App** called 'Heathrow Airport Guide' features terminal maps, guides for the shops and restaurants and live flight updates 	▪ Information on the move ▪ Simulating a new airport experience	Heathrow Hong Kong International Airport
• To engage passenger in the waiting area and to gain on any possible revenues / customer interaction touch points in this time	▪ **Smart App** that integrates Foursquare and Facebook Places in real time as passengers check-in into the airport 	▪ Offer special deals to consumers/ passengers via social networks	DFW Dallas/Fort Worth International Airport
▪ Proactive information to passengers on promotions/ discounts/ offers	▪ **Multi-touch devices** are being used in airports to communicate with passengers ▪ **QR codes** downloaded by passengers on their smart phones entitle them to receive discount coupons from airport	▪ Inciting customer for sale to improve conversion	ANA Aeroportos Lisboa Hartsfield-Jackson Atlanta International Airport

Sources: CPRDT Lab Analysis; Switched.com; Motorola.com; Secprodonline.com; Airport-world.com.

Use of Biometrics based technologies, RFID and smart apps have enhanced the passenger convenience, alongside supporting airport operations (5/5)

Arrival (Immigration & Customs - Baggage Claim – Waiting time)

Touch Points	Technology	Technology Deliverables	Key Adopters
Immigration & Customs ▪ To minimize 'Stop-n-Go', providing seamless flow to passengers without major stops in between	▪ Use of – **Biometrics based system** involves fingerprint recognition or iris scanning Eg. Fully Automated Seamless Travel (FAST) at Changi Airport 	▪ No more customs & immigration forms to fill in ▪ Speeds up frequent flyer check-in and immigration clearance ▪ Facilitates 'fast-track' processing, including fully automated immigration lanes or gates while providing more secure and faster border Crossing	CHANGI airport singapore; Schiphol Amsterdam Airport; Hong Kong International Airport
Baggage Claim ▪ Lost Baggage/ Un-traceabliity for certain valuable items ▪ Overcome limitations with the printed tags for luggage, which are usually of poor quality and difficult to scan with bar-code readers	▪ **Radio Frequency Identification (RFID)** for baggage-management 	▪ Reduction in Baggage-handling errors ▪ Enhance security in airport baggage collection and can be easily integrated into anti-theft systems for tracking the location of valuable items using GPS technology	Hong Kong International Airport; ANA Aeroportos de Portugal
Waiting time ▪ Passenger just waiting with no value add/ use to the time available	▪ 'FLYsmart' **mobile app** designed to guide travelers through the airport whilst also providing information about surrounding hotels and city attractions, plus live feeds of flight related information	▪ Information on the move ▪ Availability of easy/enough information to make a right move, once the passenger steps out of the airport	Hong Kong International Airport

Sources: CPRDT Lab Analysis; En.spireresearch.com; Gizmag.com.

Revenue Generation – Technology Solutions

Digital technologies to improve non-aeronautical revenue stream for an airport (1/3)

Technology	Application Area	Benefits	Key Adopters
Digital signage poster systems/ Video walls 	▪ Optimized space management across airport	▪ Improved revenue from more advertisements ▪ Enhanced space management	Heathrow Official airport website; Sydney Airport; Copenhagen Airports CPH; SFO; Albany International Airport
WorldPoint cards 	▪ Retail shops & Hospitality in waiting area	▪ WorldPoints earned by shopping on the airport can be exchanged for rewards including airport shopping vouchers, discounts on car parking and Express bookings, Airmiles and frequent flyer miles with the Airways	Heathrow Official airport website
VC Conferences with ▪ Telephony ▪ PDQ connectivity ▪ Managed LAN Services ▪ Wireless LAN ▪ IPTV - television connectivity ▪ Video Conferencing 	▪ Conference rooms, Meeting rooms in waiting area	▪ Telepresence rooms within the airport offer high-end, life-size virtual conferencing on a per-hour basis to enable “face-to-face” business meetings around the world which creates airport as temporary office for business class	Heathrow Official airport website; Sydney Airport; Copenhagen Airports CPH; SFO; Albany International Airport

Sources: CPRDT Lab Analysis; m2ksys.com; heathrowairport.com; Sydney airport.

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Digital technologies to improve non-aeronautical revenue stream for an airport (2/3)

Technology	Application Area	Benefits	Key Adopters
Interactive Mylar screens ▪ Screens interface with passenger devices, triggering customer data to appear on the screen wherever the customer may be 	▪ Across the airport terminal	▪ Helps to provide passenger-specific retail and hospitality offers on their mobile phone based on customer information gathered by the airport ▪ The offers can be tailored to passenger demographics, flight purpose (business, recreation, tourism, etc.), or destination	CHICAGO CDA DEPARTMENT OF AVIATION
Smartphone Application ▪ Downloaded by travelers on their mobile they can used as a channel for one-to-one marketing 	▪ Retail area and stores across airport	▪ Help customer to get club passes, sales & offers in retail stores on the airport and stay updated with news, photos, events and shows. ▪ Real-time information delivered to individuals based on need and location	Heathrow Official airport website Sydney Airport Copenhagen Airports CPH SFO
Augmented reality ▪ The Yelp iPhone app, Monocle uses the camera, along with overlaid information, to present location data while looking at the “real world"  	▪ Navigating the airport terminals	▪ Airline and airport merchant offers would be integrated into the displays	Copenhagen Airports CPH
Digital Media Download kiosks 	▪ Retail shops & Hospitality in waiting area	▪ Give travelers greater access to entertainment options ▪ Enable travelers to purchase and download movies, music and games for computer, netbook or tablet playback	SFO QANTAS

Sources: CPRDT Lab Analysis; Chicago Airport; Horizon 2010 Penary-2010 Forrester Research – SITA; Albany Airport; businessinsider.com

Digital technologies to improve non-aeronautical revenue stream for an airport (3/3)

Technology	Application Area	Benefits	Key Adopters
Digital interactive displays – including 3D, interactive dressing-room mirrors, kiosks with virtual customer-service representatives and shopping carts and digital scanners that offer personalized discounts 	▪ Retail shops & Hospitality in waiting area	▪ Engaging customers in a simulating environment ▪ Increase footprints in retail stores	John F. Kennedy INTERNATIONAL AIRPORT
Mobile devices as personal travel folders and e-wallets 	▪ Across airport and on aircrafts	▪ Helps travelers to pay for everything from excess baggage to airport taxes and duty free shopping	O·R·TAMBO INTERNATIONAL AIRPORT AIRPORTS COMPANY SOUTH AFRICA
Self Serve Order and Pay Kiosks ▪ To place orders and pay for food without staff assistance. 	▪ Retail shops & Hospitality	▪ Helps in shortening lines and speeding service for travelers who need to get to their gate quickly ▪ The solution also Supports multiple tenders (cash, debit, credit cards) and lets customers to order in their language of choice	SFO QANTAS

Sources: CPRDT Lab Analysis; online.wsj.com; ncr.com; jcdecauxna.com

