Airports need to "Smarten Up: The Need for Smart Airports as Examples for Smart Cities

Author: Dr. John A. Kolmos

[1]Department of Business and Economics, York College (CUNY), 94 - 20 Guy R. Brewer Blvd.

Jamaica, NY 11451

*Email: jkolmos@york.cuny.edu

Abstract

This paper looks at considering airports as in and of themselves "Smart Cities". Airports, especially large megahubs like Atlanta, Dallas/Fort Worth and Kennedy should be a much more seamless and pleasurable experience instead of a stressful one. One should not have to arrive hours ahead of time for a flight that many times takes less time in the air than on the ground. The airports role should be one of facilitator along with the airline as the choreographer of the smooth actions for maximum efficiency for the traveler. With the technology available today this paper will investigate what a stress free and seamless travel experience should entail. Tomorrow's airports are expanding and even today we have new megahubs. The key to all this is to integrate this process with all stakeholders involved. Those for example would be the airlines, retailers, restaurants, parking facilities and the airport itself. A model like this can help the airports cross-sell passengers and all benefit. However, not only the airports and stakeholders, but also the travelers themselves need to accept change.

Keywords: Airports, Smart Cities, Smart Airport, Safety, Security, Airport Security

1   Introduction

Let's imagine our airports as in and of themselves like "Smart Cities". Airports, especially large megahubs like Atlanta, Dallas/Fort Worth and Kennedy should be a much more seamless and pleasurable experience instead of a stressful one. Airports should be as service conscience to the passenger as any 4-5-star hotel, restaurant or any other venue is. One should not have to arrive hours ahead of time for a flight that many times takes less time in the air than on the ground.

If you think about it, an airport should be one of the most integrated and seamless experiences in modern life. Our aircraft have progressed over the years to function seamlessly from departure to destination. The pilots can program them from takeoff to landing and if their company, so choose to have little direct manual input. Why not the airports they fly from. We are still in the 1950's and 60's technology and passenger interface. Let us look at it from a logistics perspective of the trip. That is determined the moment someone books a flight. The airport's role is the facilitator for the traveler and the airline because it has the itinerary for both parties so should be able to provide a seamless and efficient experience. With all the technology available to both the airport and the airline with the ability for the passenger to access this through smart phones this should be a "no brainer". Nevertheless, it is not.

One of the major reasons is that most airports have not used the technology available to them in an efficient manner. You have arrivals and departures, video surveillance communications both private and public and public and private WiFi/internet/intranet managed by separate departments. This network jumble spread out across different channels is not more secure and certainly not conducive to a seamless operation operating at optimal efficiency.

Communications: A Critical First Step

Modernizing communications is a first and crucial step for improving and expanding a network infrastructure. When a person plans a trip, they are not necessarily looking for the fastest travel time but are looking for the least stressful travel and smooth communications improves this immensely. Airports since they are the lead facilitators in the traveler's plans have to keep up with this generation of travelers who just think differently than yesterday's traveler. Airports need to come out of the 20th century and enter the 21st with all it innovation and technology. It's about convenience and then price point

In other words, airports need to get smart, not just dress the part. "Modernizing [airport] communications network infrastructure is a critical step," writes Richard van Wijk, head of Aviation Practice, Nokia, a telecommunications consultant who oversaw the first LTE air-to-ground network for aviation in Europe, on SmartCitiesWorld, a website about smart

city infrastructure. "The reasons are clear: Smart airports, smart cities, smart anything depend on data, and communications networks are the means for transporting and analyzing that data."

Tomorrow's airports are coming today. The new megahubs like Istanbul New Airport, Dubai World Central and Beijing Daxing International have each been designed to accommodate upward of 150 million travelers a year (Afar Media, 2019)! That's half the population of the United States. The airports will have automation regarding bag drops, ticketing, and biometric scanners; it will seem like you are on a main plaza of a modern city with shops for all tastes, bars, public spaces and nice as well as family friendly restaurants. These airports coming now and in the future will fully exploit these new technologies including powerful processors, mobile apps for their smart phones and even behavioral analytics. The key to all this is to integrate this process with all stakeholders involved. Those for example would be the airlines, retailers, restaurants, parking facilities and the airport itself. A model like this can help the airports cross-sell passengers and all benefit. So now we are looking at not only passenger convince but a serious uptick to the stakeholders of the airport.

As airports expand their services, they will become better connected, too: Airport technologies will communicate with one another, breaking the "one service, one technology" relationship (Streitz 2017); beacons and GPS will create a more dynamic airport that is responsive to travelers' needs. With these improvements, the airport increasingly resembles the smart city (Apex.aero, 2018). "Airports are like cities in microcosm, and they face many of the same challenges as the cities they serve," Streitz writes (2016).

The first airports laid down the necessary runways, taxiways and ramp areas for aircraft to take off, land and move about the airport. The design was that of a train or bus depot. They had limited infrastructure but were sound. But as aviation grew, more passengers, more aircraft, greater needs for passenger parking, security and convenience, many never kept up. Streitz (2018) states that as airports evolved from big buildings on the outskirts of cities where flyers meet their airplanes to vibrant venues accessible from the city, travelers now see airports differently, too. Streitz (2016) further observes: "Commercial aviation is a very competitive business, and the airports that offer the most attractive facilities and amenities – along with operational excellence – tend to win out in the competition for routes and travelers."

While an office buildings, shopping malls, a hotel, a train stations or an airport seem to serve very different purposes when looking at their primary function they all serve a customer who is looking to improve or add to a lifestyle in the least stressful way possible. This is due to a change of people's roles within short time frames or parallel activities in co-located situations (Streitz, 2017). "Large airports are good examples of this blending of activities. They aim at providing a range of functions people are usually looking for in cities, everything a passenger may need has to be there. Translating this in an overall design rationale, one can state: designing airports is designing transient smart cities (Streitz, 2016)".

Airports are a microcosm of an Urban and diverse environment. They are relevant to the economy and the challenges of the communities in which they are established. They should be an example of transforming technological environments. Hence, "Smart Airports" can be the example for smart cities. Starting on a smaller scale which would then evolve to the larger city size scale like a New York or Boston. The airport needs to exploit the power of the technologies available today and coming online tomorrow especially with the dawning of 5G. It can build an infrastructure combined with processing power for many embedded systems and in turn interact with media and the physical environment itself. Smart airports will need to adapt these technologies to take advantage of these urban and

diverse environments they find themselves in and realize that the airport can be a bridge to local communities.

The traveler must be in the center of this technology and it must be service oriented to their needs. Which in turn can not only be a more pleasing experience to the passenger but in turn help the bottom line of the stakeholder. This requires designing from a passenger perspective, facilitating and transforming the "Passenger Experience" into a coherent, efficient, and pleasant experience. The travelers experience should be seamless, less stressful and even rewarding. Smart technology can do this. A Smart Airport can be a welcoming experience for the traveler instead of the dreaded one it is today.

What is a Smart Airport?

Going to an aviation conference can be an overwhelming experience. Hundreds of companies offer a dazzling array of devices and software applications that—so they claim—will reduce labor costs, raise profits, and improve the passenger experience. With so many vendors offering high-tech "solutions" for every imaginable task, it's easy for airports to lose track of the big picture—and of the bottom line-profits. Less successful airports risk investing in pricey new gadgets, many of which do not have a proven track record. Smart airports focus on their own priorities, not on helping tech firms meet their sales targets. They need to be open to adopting new technologies, but in turn not afraid to ask tough questions. How does this benefit the passenger and "me"? Is the high cost of this device/this software really justified, or is there a cheaper, low-tech alternative? Is this talking robot/VR goggle/interactive tablet just a gimmick, or is it a useful amenity that will enhance the customer experience? Is the interface user-friendly, or will it frustrate my passengers and employees? How long will it take for this new technology to deliver a tangible real benefit experience for the traveler? If we are talking five or ten years down the road, will it be obsolete by then? What does the airport's bottom line look like after adopting this new technology?

Some investments in technology are a no-brainer. At a recent SMART Airports conference in Singapore, Zurich Airport's Daniel Bircher (2019) pointed out that free, unlimited wifi has basically become an industry standard. Passengers expect to get online with a single click. If your airport has spotty wifi, or if internet access requires some kind of weird registration process, it drives down customer satisfaction. It reflects poorly on the airport, and on the country that it serves. This is true anywhere in the world. But when it comes to most new technologies, smart airports evaluate the local context before deciding whether to invest. In an advanced economy with high wages and high levels of technical literacy, new technology can make airports easier to navigate and cheaper to operate. Tech investments can be a smart way to reduce an airport staffing needs. However, in developing and middle-income countries where much of the growth in aviation is now taking place wages are low. There are also plenty of infrequent travelers who are unfamiliar with things like biometrics, self-check-in, and app-based procedures. They will need a lot of help from ground staff. In that kind of environment, it's difficult to justify the big capital expenditures that new technologies entail.

In advanced economies, on the other hand, experienced travelers welcome the convenience of digitalized procedures. With todays youth, digitalized procedures are a normal mode of existing. But they are also easily annoyed by buggy apps and dysfunctional e-gates and aren't shy about voicing those complaints on social media. To avoid bad publicity, smart airports should partner with firms that focus on the customer experience. They will need to introduce user-friendly interfaces that are easily operated by all passengers, those not as tech savvy.

Finally, tech savvy travelers are increasingly asking pointed questions about how airports and airlines are using their data. Privacy is still important to people. Information in cyber space about them causes caution and useless unused technology. To protect themselves against expensive legal actions, smart airports are now developing a sound data protection policy that clearly outlines how passenger data is captured, stored, and analyzed, and explains how customers can opt out of those processes.

Smart Security

While people expect a high level of safety during their travels, their tolerance for the inconvenience this can cause is not always high with long lines at checkpoints. This will quickly overshadow any assessments that may have been made about the processes ability to keep them from harm, as well as leave a person unhappy even with Smart Airport Technology employed. Smart Security needs new technology with the stated aim of making security screening more sustainable (given the predicted rise in passenger numbers) and less disruptive to people's journey. The security process is perhaps near number one of the passenger complaints at large mega-airports (Boston.com, 2019).

Individual components of the system have already been tested in airports, including at London's Heathrow and Geneva, and the next step is determining how they work together. As Angela Gittens, director general, ACI World, explained at the time the program was announced: "A touchpoint in the passenger journey that triggers a sense of dread is the security check. Through Smart Security, ACI and IATA will drive the needed change.

"Airports, airlines, control authorities and system suppliers all have a role to play in making the process more effective, efficient and pleasant for the passenger. Smart Security brings these stakeholders together with the shared goal of transforming the security checkpoint for the benefit of all the travelling public (Gittens, 2018)."

But there are wider ambitions as well. Technology is already changing passengers' experience at the airport from the time they check-in through to the time they board an aircraft. And, capturing and connecting the information gathered at each stage of their journey is one of the biggest challenges we face as we plan for more streamlined services.

Building Blocks

One of the initial requirements at an airport or in any environment that requires controlled entry and exit, is confirming the identity of the passenger. Atkins' Passenger Authentication Scanning System (PASS) (Atkins, 2018), which has been implemented at Heathrow since 2012, uses advanced facial biometric technology to link passengers to their travel documents as they pass through security checks.

The infrared facial recognition system, developed by Aurora, was accepted because it gives reliable results even in variable light conditions. During trials, airport operators and providers explored the ways in which passengers interacted with the technology and determined how the experience at checkpoints could be enhanced. The system that has now been implemented balances a number of factors. They include:
Speed: The image capture and verification of identity can't create delays. The system must be easy to use, keeping in mind most people will be infrequent passengers and self-service options are needed

Security: The system must meet the stringent standards of the relevant authorities, in this case the

UK's Border Force

Cost: The security solution must operate on the airport's standard client and server machines

It has already been applied in a self-service environment. Passengers' biometric information is captured at e-gates prior to entry to security, so they can be checked later in the process as they seek to leave the departure lounge. The early indications are that the benefits of the technology extend beyond security as well. Travelers, for example, welcome self-service options, particularly if they smooth their journey. It also enables other airport services to become automated, which is good for airlines and operators. Last year, passengers at Heathrow's Terminal 1 trialed a self-boarding scheme through an e-gate controlled by PASS (Atkins, 2018). The trial was conducted in partnership with South African Airways Speaking recently about the trial, Heathrow's Terminal 1 director, Ian Hanson, said: "We are working in partnership with our airlines to trial this technology which should help make our passengers' journeys smoother and simpler. Since its introduction we have had positive feedback from both airlines and passengers (Heathrow Press, 2013)." Technology that allows authorities to link an image of a person's face to a travel document is one of the building blocks of the SmartS program. Trials have shown that biometric facial recognition can be used to accurately check identity. IATA, working with Heathrow and Atkins, demonstrated the capability to check that the person presenting an e-passport was its owner. This opens up the possibility of a full self-service channel through the departure process, and acts as a key trigger in the SmartS vision.

A Positive Experience

Supporters of this program speak highly of it as "an uninterrupted journey from curb to aircraft door". While it's acknowledged that this will take time and there are numerous hurdles to overcome before the vision becomes a reality, the technology to transform the passenger experience already exists. But a final solution will need to amalgamate online check-in, airline data, biometric technology and departure lounge systems into one seamless end-to-end solution. People already check-in online, drop their bags at self-service bag drops and use electronic boarding passes, so why not a "Smart Security" check in procedure?

Staying Connected

Airport environments can be very complexed and disorienting to many passengers, especially international passengers. There is no need for this as technology is available to make this a more pleasant experience even in concerns for safety and security. Very little is achieved by working in a bubble. Associations like IATA and ACI together backing a system like SmartS can improve the passenger experience making another hurdle-safety and security much easier to transit. Participating groups working together helps all to benefit in the end.

Smart Parking

The three main sources of non-aviation income: parking, terminal concessions, and property development. For some airports, parking is the most lucrative of the three. Unfortunately, it's also the most vulnerable to disruption. For decades, ground access—how passengers travel to and from the airport—wasn't exactly a dynamic field of research. Year after year, most travelers came to the airport by car. They drove there themselves, asked a family member to drop them off, or took a taxi. When they landed, many of them rented a car. Airports monetized these activities by charging their customers to park at the airport, by leasing land to car rental companies, and by levying access fees on taxi companies and greeters. As passenger volumes grew, airports became surrounded by acres of parking lots and garages.

How people travel to and from the airport—what planners call the "modal split"—varies considerably around the world. Asian and European cities tend to have a much higher share of public transport users. In Hong Kong, less than 10% of passengers take a private vehicle to the airport. That's

because there are plenty of convenient, comfortable, and affordable alternatives: express buses, subways, ferries, high-speed rail. The same is true in Shanghai, Seoul, and Tokyo. It is also the case at European hubs like Amsterdam, Frankfurt, and Zurich, where the modal split is evenly divided between public and private transport users. But at most of the world's airports—from Peoria to Perth—travelers overwhelmingly come by car. That is especially true in small cities, rural areas, and emerging economies, and that is unlikely to change in the near future.

Off-Airport Parking and Ride Share

Airports face fierce competition from low-cost parking lots located just outside the perimeter fence. Improvements in technology are making this more attractive for passengers, who can pay for parking and send their flight details in advance, which minimizes waiting times. Many passengers were interviewed during a recent research conducted in the US who sang the praises of offsite parking. It's putting a major dent in the leisure travel market, and it's driving down the price of on-airport parking. Technology is also driving down the price of hiring someone to take you to the airport. Twenty years ago, you could routinely shell out $60 for a 20-minute cab ride from Boston's Logan Airport out to the suburbs. Today one could pay half that amount—or even less, if you carpool with others. Although their long-term business model is highly questionable, ride-hailing and carsharing firms like Lyft, Uber, and car2go have disrupted the airport ground access model: first by challenging the taxi monopoly, and second by offering a product that is more convenient, and often cheaper, than parking at the airport or renting a car.

Autonomous and Electric Vehicles and the Environment

This is a moving target, and one can be overly skeptical of the optimistic projections that promise a 100% driverless, 100% electric future any time soon. What's clear, however, is that AVs and EVs will fundamentally change how airports design for automobiles. In the near term, the biggest challenge will be to build parking facilities, access roads, curbsides, and charging stations that can accommodate both human-operated and driverless cars. Smart airports are already investigating how landside facilities can be optimized for that evolving fleet mix of mixed vehicles. The environmental ethics of driving has become a polarizing political topic. Urban voters are pressuring their elected officials to discourage car use—for example by raising tolls and gas prices—and to invest in mass transit and alternative fuel sources. People living in rural areas see these measures as threats to their livelihood, and as an attack on their way of life. Suburban folks are caught somewhere in between—as are airports. Moving forward, airports will need to serve customers who want convenient car access, while at the same time demonstrating a commitment to sustainable alternatives.

Focus on the Customer

Premium parking—with perks like curbside valet drop-off—will undoubtedly continue to be favored by well-heeled customers. Similarly, cheap off-airport parking will likewise continue to thrive. But everything in-between—like a dingy garage that's poorly connected to the terminal, and where you have to wait in line to pay—is likely to become a thing of the past. How can airports engage with this paradigm shift? Smart airports start by focusing on their customers. That's because they understand that disruptions in the automobile industry will not affect all airports in the same way. Airports whose customers live in dense cities, are tech-savvy, and use a mix of public and private transport in their daily lives will be at the forefront of change. On the other hand, airports in suburban and rural areas—where customers skew older cars, and car ownership is the norm—

will likely see continuing demand for traditional parking and car rental services. Second, smart airports establish partnerships to improve their parking product. They partner with airlines so that passengers can pay for their flights and parking in a single transaction and throw in added perks like lounge access and fast-track security. Others work with local businesses to provide car repair and maintenance services for long-term parking customers.

Smart airports are also partnering with the disruptors to innovate the passenger journey. As Cincinnati airport's Chief Innovation Officer Brian Cobb recently explained that CVG is exploring how to install bag-tagging technology inside vehicles operated by ride-hailing services. That's good for passengers, who can save time at the airport, and it's good for the airport, which can move passengers more quickly to the airside. Thinking ahead, smart airports are studying how autonomous vehicles can help to cut parking costs. One model anticipates that AVs will drop passengers off at the curbside before proceeding to a parking garage. If customers no longer need to enter the garage, then the ceiling height could be reduced from that of a human being to the height of a car, allowing for more efficient storage. You could also eliminate lighting, as has been done in automated factories. Moreover, if AVs drop passengers at the terminal, they could then be stored at a remote location on the edge of the airport. That would free up valuable land where garages currently sit, which can then be put to better uses: like terminal expansion projects, or landside commercial development. That could be a big win for space-constrained airports, and for airports looking to grow their real estate portfolio. To some ears, this might all sound like science fiction. But if we've learned anything over the last 100 years of civil aviation, it's how quickly and profoundly a new technology—from the jet engine to the smartphone—can transform the industry. Smart airports are aware of that history when planning the future.

Rethinking Luggage

Smart airports need to ask themselves if a process needs to take place inside the terminal itself. Can it be better and more efficiently accomplished someplace other than the terminal. Hong Kong for example as early as the 1990s had check-in terminals where a passenger could drop their bags and procure a boarding pass without leaving the city proper for the airport. Other cities than followed suit like Vienna and Seoul. However, the practice has not made any inroads to major markets here in the US. It's ironic considering that the world's first downtown check-in terminal was in fact located in Midtown Manhattan.

Baggage and baggage check in remain on the top of the complaint list of passengers traveling the airlines right up by delays. Carrying luggage is considered one of the most stressful aspects of flying for passengers. They worry about luggage being stolen or damaged which is why there has been such an increase in customer carryon's, thereby slowing boarding and causing delays. Also, passengers carrying bags makes them less likely to use the shops in the terminal a major money maker for the airport and its stakeholders. Off-site check-in terminals are one way to help travelers deposit their luggage before they even arrive at the airport. Pop-up bag-drop facilities at festivals and trade fairs can also help airports manage the spikes in traffic that accompany such large events. Baggage pick-up services at the customer's home or office, offered e.g. in London and Dubai, is another smart strategy. And over in the US, some forward-thinking airports are partnering with ride-hailing apps, installing bag-tag printers inside the vehicles that passengers use to travel to the airport. Smart airports need to rethink how passengers travel with their luggage, such as outsourcing bag drop-off, transfer, and delivery through a variety of creative ap-

proaches. Industry leaders need to develop solid partnerships and innovative profit-sharing models between airports, airlines, ground handlers, and local transport operators.

Conclusion

Airports need to become "smart" to make the passenger experience pleasant and welcoming. Travelers most dreaded part of their journey is the airport experience. It takes up a large portion of there day and is often peppered with frustration, stress and anxiety. Travel time should not be wasted at the airport but used efficiently to move people from point A to point B. The whole purpose of air travel was to get to those point fast. When one needs including travel time spend three or four hours from home to airport making it longer than a short flight to a neighboring state something needs to change.

Redesigning the passenger journey through clever and innovative uses of technology, design, and manpower can bring a promise to significantly increase customer satisfaction. It can also be a big win for airport operators, who can reduce costs and increase capacity inside space-constrained terminals. Thereby increasing the stakeholders bottom line. At the same time, smart airports need to recognize that resistance is an inevitable part of innovation. Everybody wants change, but nobody wants to change. Passengers and employees may be unwilling to change their habits, particularly when confronted by new technologies. Baggage and carryon are a large revenue gathering for many airlines in today's world. Numerous parties within the aviation industry have a vested interest in maintaining outdated operational practices, even when those practices constrain future growth and drive down the customer experience.

Smart airports along with the men and women who lead them need to tackle those barriers head-on. They need to deploy intuitive technologies that passengers find easy to use. They need to invest in the technical literacy of their employees. Above all, smart airports will need to understand that innovating the passenger journey will also drive innovations in the airport business model, as old revenue sources and cost centers are replaced by new ones. This will increase customer satisfaction and ultimately increase their bottom line.

References

Beijing's Massive Zaha Hadid–Designed Airport Is Now Open. (2019). Retrieved November 5, 2019, from https://www.afar.com/magazine/beijings-massive-new-daxing-airport-is-open.

Atkins (2018). Retrieved November 16, 2019, from https://www.atkinsglobal.com/en-gb/projects/passenger-authentication-scanning-system-pass

Bircher, D.(2019). Retrieved November 16, 2019, from https://smart-airports.com/sea/programme/

Boston.com (2019). Retrieved December 6, 2019, from http://archive.boston.com/business/gallery/airline_passenger_complaints/

Gittens, A (2018). Retrieved December 6, 2019, from https://aci.aero/about-aci/aci-world-staff/angela-gittens/

Heathrow Press (2013). Retrieved December 6, 2019, from https://mediacentre.heathrow.com/pressrelease/details/81/Corporate-operational-24/4116

Streitz, N., (2019). Beyond 'Smart-Only' Cities: Redefining the 'Smart-Everything' Paradigm. Journal of Ambient Intelligence and Humanized Computing. vol. 10, no. 2, pp. 791-812. (Springer). First online: 31. May 2018. DOI: 10.1007/s12652-018-0824-1

Streitz, N., (2017). Reconciling Humans and Technology: The Role of Ambient Intelligence. Keynote Paper. In: A. Braun, R. Wichert, A. Mana (Eds.), Proceedings of the 2017 European Conference on Ambient Intelligence. Lecture Notes in Computer Science (LNCS 10217), Springer-Verlag. (pp. 1-16).

Streitz, N., (2016). Opportunities and Risks of Digitalization in the Context of Smart Hybrid Cities and Airports. In: Proceedings of USEWARE 2016 - Mensch-Technik-Interaktion im Industrie 4.0 Zeitalter. 8. VDI-VDE Fachtagung. VDI-Berichte 2271. VDI Wissensforum. VDI-Verlag (pp. 5 - 14).

Wijk,R.V.(2018).Aviation Practice Leader, Nokia; Retrieved November 20, 2019, from https://www.internationalairportreview.com/article/79164/coordinating-communications/