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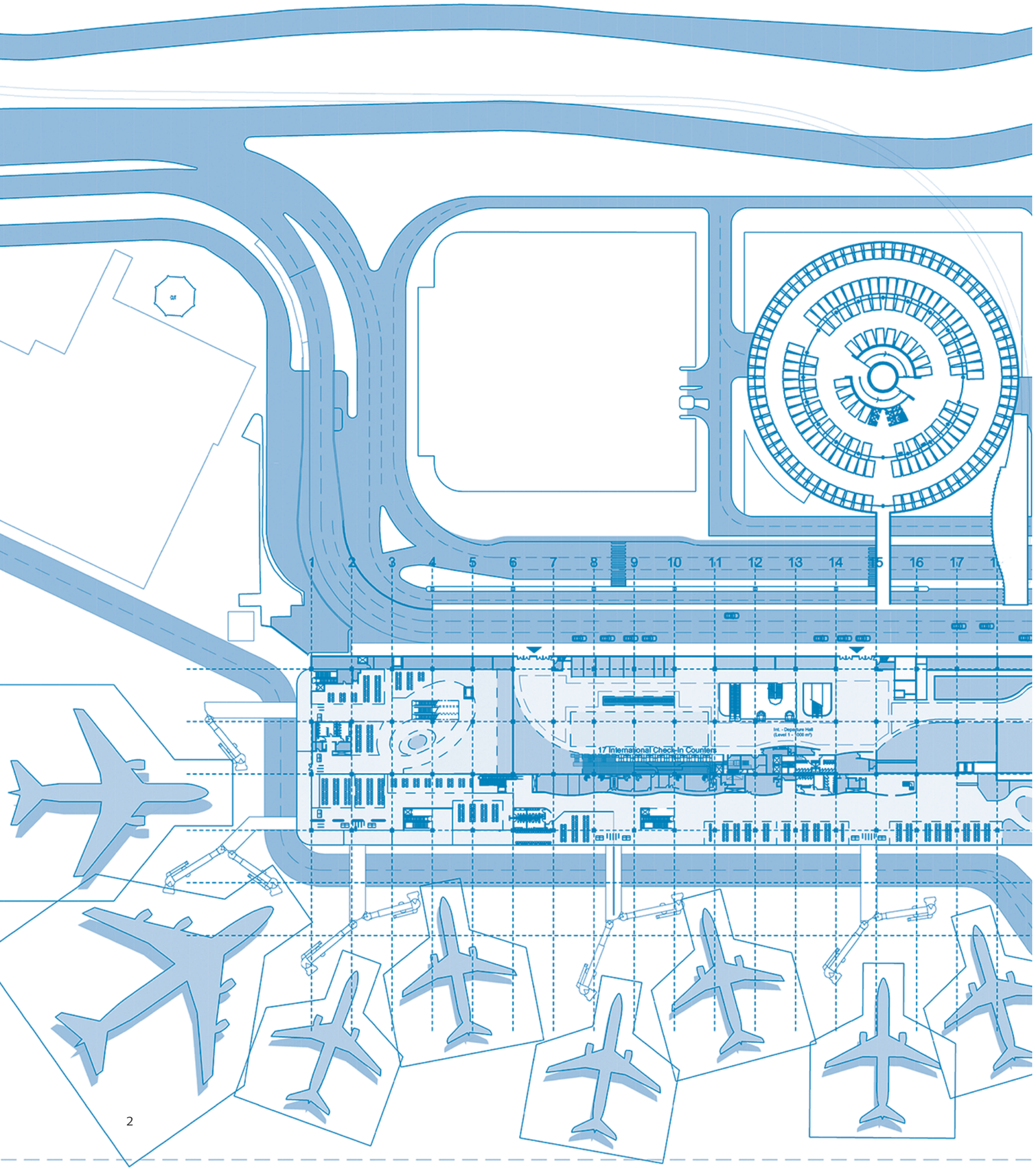
strategic airport development

HOLISTIC, DIGITAL, SUSTAINABLE:

REFLECTIONS ON THE STATUS OF AIRPORT DEVELOPMENT



CONTENT

PREFACE

Corona! Covid-19! Social distancing!
Drastic and never before seen reduction in aviation traffic!
Re-start, rebound, hope and second wave!
How can we make sure that the basic trust of the passengers returns to air travel?
These are the challenges we face together.

And that is just on top of the ongoing changes such as digital transformation, the demand for environmental sustainability, and external threats to revenue streams. Many airport operators are left wondering if fundamental changes to their business model will be necessary, and if so, when and what type of changes. As planners and consultants, these developments have led us to completely rethink our approach to better meet our clients' needs.
Long before the COVID-19 pandemic, we began to address some of these challenges.

So instead of just highlighting our most recent successes, we wanted to present you with a series of less hectic and ad-hoc insights in our work.
In this brochure, you will find a collection of our ideas and activities from the past three years, as well as the approaches we have developed in a variety of projects. We share our thoughts on privatization, the increasingly digital industry, the call for greater sustainability, and what we see as the holistic, digital, and strategic solutions we need to meet these challenges head-on.

Even though much has changed, we are still optimistic about what the future will bring. We are proud that at the beginning of 2020 we were able to intensify our collaboration with our long-time project partner Munich Airport International (MAI), which is now our majority shareholder. We look forward to continuing these important conversations with our new partner, our customers and industry leaders in the years to come.
The future for us will not be a return to the pre-Covid-19 days, but will be a completely new perspective, with risks but also great opportunities.
We invite you to join us in this exciting development in the years to come.

the amd.sigma team

STRATEGIC DIGITAL PLANNING IN AIRPORT DEVELOPMENT

INCREASES IN GLOBAL AIRPORT TRAFFIC WILL REQUIRE ROBUST NEW CONCEPTS FOR BOTH PASSENGER SERVICES AND AIRPORT INFRASTRUCTURE.

TEXT: ADAM SYMALLA

Promising solutions can be found in digital, provided that it is embedded in seamlessly connected systems. Digital topics should be a clear priority in the early phases of development projects and a strategic mindset is key. Strategic digital solutions must account for the business objectives of all stakeholders while maintaining a strong focus on passenger experience.

DIGITAL TRANSFORMATION IS AN IMPERATIVE – AND A CHANCE

Over the next two decades, despite ongoing climate debates, experts predict that we will see a twofold increase in global airport traffic. But a simple linear equation that doubles the current capacities will not be enough to deal with this drastic change. Such an approach will falter in terms of both feasibility and financing. Throw in the lengthy planning and approval processes that come with expansions and the problem only gets bigger.

The need for new and improved airport infrastructure is undebatable. And to make it happen, well-executed digital integration will be an absolute must.

When it comes to passenger services, the current landscape of digital processes and concepts is often fragmented and not integrated over the entire passenger experience. Passengers today often encounter a vast array of concepts, systems and applications during a single trip.

This situation raises the question of how digital solutions can become an integral part of airport master plans and development projects – to improve revenues for airport operators and stakeholders while maximizing benefits and supporting a positive airport experience for travelers.

WHY AIRPORTS, AIRLINES, AND PASSENGERS SHOULD EMBRACE DIGITAL

Airports are meeting points for multiple stakeholders and interests. Digital technologies offer a host of advantages to serve their needs. As an example authorities have fast, reliable access to passenger information thanks to automated systems. This makes it easier to screen passenger documentation and profiles and improves overall security. The upshot for many passenger services is higher speed and efficiency, so airports can ultimately handle more traffic and baggage and potentially even reduce the space required for various processing steps.

Airport operators work to achieve different objectives. For one, they want to ensure stable, efficient and hassle-free passenger processes. Going digital lowers the costs of reaching these objectives. Second, they want to move passengers through the terminals quickly so they have more time to shop, yielding higher non-aviation revenues. Operative transactions are frequently used as another means of bolstering bottom lines that generate ancillary revenues through the sale of additional services.

Third, airport operators strive to make the passenger's stay as stress-free and convenient as possible to improve the quality of the passenger experience. Because we all know by now that happy passengers mean higher non-aviation revenues.

When it comes to airlines, flight operators want to prevent delays and maximize flight rotations. They want passengers ready and waiting at their gate to ensure that on- and off-boarding processes can happen as quickly and smoothly as possible. Finally, while the specific needs of passengers will depend on the purpose and duration of air travel, most want their experience to be fast, safe, and on schedule, from departure to landing. Far less important to end consumers is who is actually running their digital services.

STUMBLING BLOCKS AND PERKS OF DIGITAL TRAVEL

While new digital concepts and systems hold great potential, they also pose challenges. One of the greatest for the world of air travel is adopting a holistic, passenger-centric approach. Right from the get-go, airport planners are often reluctant to consider new technologies. Roles and responsibilities for introducing and managing digital solutions are frequently unclear. These difficulties stem in part from the inherent complexity of digital solutions. To enable an efficient and mutually beneficial data exchange for all relevant stakeholders, defining a legal framework is a crucial first step.

Given this complexity and multitude of interests, the importance of having a holistic digital strategy becomes startlingly clear.

Once roles and responsibilities are defined, digital transformation offers excellent opportunities for airport operators and other stakeholders. In the future, airports will also need to rethink the very definition of their role and services. Instead of just providing physical infrastructure, they will increasingly offer IT solutions and services to coordinate ground processes. Once this fundamental shift becomes apparent, so will the need to increase investments in IT, process optimization and staff training above traditional CAPEX. And digital strategy should be factored in as an essential component at the master plan level.

HOW CAN WE IMAGINE THE AIRPORT OF THE FUTURE?

When we hone in on the specific touchpoints along the passenger journey, it becomes clear that digital solutions truly have the potential to transform airports. From check-in to security to boarding, baggage pickup and the non-aviation sector, here's an overview of what might change and where airport planners will need to consider additional solutions for new challenges that crop up along the way.

1. DOWNSIZED CHECK-IN SOLUTIONS AND ENHANCED PLANNING

The airport of the future will transform the check-in process. Thanks to new digital solutions, spacious halls with row upon row of check-in counters will most likely be cut in size or even cease to exist. Automated and mobile applications will allow passengers to complete most of the check-in process before they reach the airport. On arrival, they will deposit their bags into automatic bag drops. Additional solutions, such as off-airport check-ins through partnerships with courier services or other specialist providers, are also conceivable. Integrating service providers who handle luggage will make it easier to plan and govern the capacity of baggage handling systems, which would simultaneously reduce the floor area required by technical equipment. Now that both sides of the equation are set to change with digital, this and other calculations will be in need of a radical overhaul.

2. LOW-STRESS, HIGH-EFFICIENCY SECURITY CHECKS

Security checks are by far the most stressful touchpoints in the experience journey of the typical passenger. At today's airports, the specific configuration and efficiency of security checkpoints tend to vary considerably. Given this uncertainty, passengers are told to arrive at the airport well in advance of their actual departure times to ensure that they can safely pass through all necessary checks.

Thanks to enhanced technologies such as CT scanners, it is possible to move more passengers through individual security

checkpoints. But the specific devices, design and processes at these touchpoints also need to be well-integrated to ensure a steady flow. By coupling standardized processes with highly trained and motivated personnel, airports will be in a good position to handle growing passenger streams.

3. BETTER BORDER CONTROL

Automated and biometric screening at national borders tends to be highly advanced and has contributed to improvements both in the number of passengers processed and in the quality of their experience.

Even greater efficiency in data collection might be achieved through a more seamless air-to-ground transition. Immigration formalities, such as filling out visa applications on arrival, could be offered as an in-flight service with the support of a personalized inflight entertainment (IFE) system that collects and transmits biometric data to authorities at the final destination.

4. INNOVATIONS IN NON-AVIATION

With the introduction of new technologies and ongoing process improvements, it will be easier to predict the time spent by passengers at the airport. Passengers will also be able to plan their airport experience more effectively and even minimize the duration of their stay. But this change could also force operators to adapt since it could harm commercial activities and revenues from hospitality and retail. More intelligent approaches will be necessary for both retail and food and beverage (F&B) concepts. Airports may be able to entice passengers with smart to-go or delivery to gate concepts for F&B. Retail spaces should be designed as interactive experiential marketing venues rather than sites of commercial transaction. When shops become less about sales and more about intangible goods, less space will be necessary for in-store displays, as well as storage and equipment.

5. LEAN BOARDING WITH A FOCUS ON EXPERIENCE

Much like border control stations, automated checks could also be installed at boarding gates, resulting in more compact waiting areas and shorter lines. When planning these areas, airport planners could shift their focus to interaction and experience, which could very well contribute to a positive passenger journey.

6. HIGH-CAPACITY BAGGAGE SYSTEMS

Faster processing at border control stations will make it necessary to create larger baggage pickup areas, and put more pressure on ground handling agents to deliver baggage to the baggage belt even faster. Time gained earlier in the journey through efficient digital solutions could quickly be lost here for passengers due to increased waiting times for baggage. This potential pitfall requires new thinking. Smart collaborations with baggage delivery services could be one approach that makes long minutes spent at the baggage carousel a thing of the past.

MAKING DIGITAL STRATEGY A REALITY

Getting airports fit for the future will require the integration of digital strategies in the master planning stage. Master plan development isn't merely a technical blueprint. Instead, it defines the strategic focus of an airport's business model. Digital transformation is an essential element of future airport management and a must-have in terms of business strategy. All stakeholders should pursue digital solutions as a top priority that provides meaningful and efficient avenues to better capacity planning. In the same vein, digital and IT CAPEX are essential to an overall investment program.

Equipment and infrastructure solutions only work when processes have been optimized and staff trained to use them. As new digital technologies minimize personal interactions at various touchpoints, the need for well-trained personnel becomes all the more apparent.

It will also be vital to break down so-called data silos to bridge the gap between airport operators and their stakeholders and enable a productive exchange of information and data.

Finally, it is essential to keep in mind that the responsibility of airport operators will extend well beyond physical infrastructure. Future-oriented operators will redefine their roles and gradually become providers of IT systems as well as a host of processes.

CONCLUSION: HOLISTIC DIGITAL STRATEGIES WILL LEVEL UP AIRPORT PLANNING

Digital transformation is about more than technology. Instead, it offers the chance to create a holistic, company-wide strategy connecting multiple teams and touchpoints. In that sense, it needs to include specific objectives as well as guidelines for implementation. This new breed of strategy is a management topic – so management also needs to walk the digital talk. And when digital integration is taken seriously, it cannot be managed solely as the task of individual departments. At the end of the day, when airport planning is enriched by a well-connected digital strategy and clear business focus, its potential and impact can only stand to grow.

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ON THE CHALLENGES AND ADVANTAGES OF AIRPORT PRIVATIZATION

DR. LUTZ WEISSER, FOUNDER AND MANAGING DIRECTOR OF AMD.SIGMA

"The demand for mobility is growing at an enormous rate and it can only be satisfied through private investments."

EARLY EXAMPLES OF AIRPORT PRIVATIZATION DATE BACK TO THE 1980S. ARE WE CURRENTLY SEEING A NEW TREND TOWARD PRIVATIZATION?

There is nothing really new about the privatization of public infrastructure. Highways or utility companies are two excellent examples. But airports have always been a different story. It took time to convince people that private operators would be able to manage the aviation sector better. It all started with the privatization of airlines, which then served as a role model for the privatization of infrastructure. Privatization is not a new trend, but rather a development that's been going on for several decades.

WHAT ARE THE DIFFERENT MODELS OF AIRPORT PRIVATIZATION?

The simplest type is a public offering. In other words, state or federal shares in an airport are sold to the public or financial institutions for the first time. Frankfurt Airport is a classic example. Then there is what we call the "Brazilian model": a global tender process is launched to find the highest bidder, while the government retains a stake through its national airport company with shares of up to 49 percent of shares. This type of model has proven its worth in other countries as well. It is ultimately a response to the negative experience of radical privatization in cases like the British the Thatcher government, where power and control shifted entirely to private shareholders. Consequently, looking after shareholder values became a bigger priority than maintaining the infrastructure. France offers a third model: airport companies there emerged from toll road operators, which are state-controlled – so, in reality, these airports are not genuinely privatized.

HOW DOES AMD.SIGMA SUPPORT AIRPORTS WITH PRIVATIZATION PROJECTS?

amd.sigma provides support for many aspects and areas of privatization. For potential investors and operators vying for an airport, we can manage the entire bid process. That means bringing together a wide array of experts, including legal and financial advisors. We also provide consulting for investors interested in different technical development possibilities for an airport.

"Planners have to anticipate requirements many years in advance since the infrastructure will need an update every 10, 15, 25 years."

In addition, we create business plans for investors where we verify whether public officials are on the same page as our bidder – are their assumptions aligned? That's a crucial aspect since it involves procuring detailed data on both the revenue streams and operating costs of an airport. Planners have to anticipate such requirements many years in advance since infrastructure has a limited lifetime and will need an update every 10 to 25 years. In this sense, classic management consultancies rarely have the expertise we can offer. Some of our employees have decades of experience working for airports and they know exactly what it takes to get the job done

WHAT ARE SOME REASONS WHY PUBLIC OPERATORS DECIDE TO GO PRIVATE – AND DO THEY VARY FROM REGION TO REGION?

The most important reason is financial capital. Publicly operated companies usually do not have adequate access to financing that will cover the enormous investment costs – and with airport investments, we are normally talking about figures in the nine-digit range.

But financing is not the only reason. Take the United States, for example. The US has highly developed capital markets, but still no viable business model for airports. Traditionally, public airport companies in the US merely lease out airport property. They grant airlines the right to operate terminals and infrastructure based on decades-long leasehold agreements. So, there is very little pressure to initiate change. To compete in a global market, though, they still need to improve airport operations – for example by improving the passenger experience and delivering superior quality. It's incredibly difficult for the airports to accomplish this without the necessary operational experience. What's more, US federal law prohibits the current airport authorities from turning a profit.

Because of increased competition, airlines have also started to understand that they need to concentrate on their core business –air travel. More and more airport operators in the US are joining forces with the airlines and starting to privatize, although none of the projects to date has involved an entire airport.

"When an airport is successful, it has a highly positive impact on the local economy. Airports are always the largest employers in their region."

In emerging markets like India or Brazil, the motives for privatization are often a mixture of both topics: the public sector has neither the funds nor the experience with quality-driven airport operations. At the same time, the demand is extremely high. In a country like Brazil, domestic travel requires bridging enormous distances – and the current network of public roads and railroads is still sorely lacking. For government stakeholders, the easiest thing to do, then, is to build new airports with the support of private operators.

WHAT ARE THE DIFFERENCES BETWEEN PRIVATIZED AIRPORTS AND PUBLICLY OWNED AIRPORTS?

The private airports are much more flexible, more agile and more willing to take risks. They have a different relationship to

"We believe that a good airport is not only fast, efficient, and safe, but also offers a positive passenger experience – and private airports are usually better in these areas."

airport planning and development. And when an airport is successful, it has a highly positive impact on the local economy. Airports are always the largest employers in their region – from the ground personnel to the food court staff. But the differences also extend to the passenger experience: Publicly operated airports often do not have a strong customer focus. We believe that a good airport is not only fast, efficient, and safe, but also offers a positive passenger experience – and private airports are usually stronger in these areas. The main reason is airport employees who identify more strongly with their employer and enjoy better career opportunities as well as more attractive wages.

WHICH AIRPORTS WOULD YOU CITE AS POSITIVE EXAMPLES OF PRIVATIZATION AND WHY?

Successful airport privatizations succeed in integrating different systems. That means achieving a balance between airside and landside systems, between aviation and non-aviation topics, between business and operations. In Germany, we can take Hamburg, Düsseldorf, and Frankfurt as examples of different privatization models that are all highly successful.

WHERE WAS PRIVATIZATION LESS SUCCESSFUL AND WHAT WAS THE LARGEST STUMBLING BLOCK?

In countries where the legal system doesn't always work, you might see investors pulling out of a project prematurely. But there are also examples of privatization where the market expectations were entirely unrealistic. Especially in Brazil, there was a huge decline in traffic in the wake of the financial crisis and due to rampant corruption – and investors there lost a lot of money. However, when we look at these projects from a public perspective, we can still call them successful because the necessary infrastructure is now in place.

Hamburg as an example of a highly successful privatization model.

"Legal frameworks have a decisive impact on how privatization projects are perceived in terms of risk."

ARE THERE CLASSIC SUCCESS FACTORS FOR PRIVATIZATION?

Robust legal frameworks are an important factor. Legal frameworks have a decisive impact on how privatization projects are perceived in terms of risk. When investors can bank on a predictable legal system, projects are more attractive and easier to implement. The involvement of public shareholders also plays a big role – something we have observed in multiple privatization projects. In the field of airport development, there are numerous processes that involve public officials, for example the definition of certain fees, approval procedures, regulations, or special assessment taxes. These processes tend to go more smoothly when the public sector has a stake in the results. Communication with the broader public also tends to be much better.

WHAT ARE THE GREATEST CHALLENGES THAT COME WITH PRIVATIZATION PROJECTS?

One of the biggest challenges is estimating expected traffic flows. We have repeatedly observed clients who have an overly optimistic view of the development potential of their airports.

LET'S FAST-FORWARD TO 2029: WILL THE MAJORITY OF AIRPORTS BE PUBLICLY OR PRIVATELY OPERATED?

There will always be publicly operated airports. But with the US, we have a large market that is headed for change, and when it happens, we will see a wave of privatization – I am sure of it. Privatization will also continue in the rest of the world, because the demand for mobility is growing at an enormous rate. In emerging countries, we are just starting to see the development of middle classes with the means to travel. The concept of vacation has basically only now appeared in China. In these countries, we will start to see the sudden movement of enormous masses of people. This push for greater mobility will result in the demand for a transport infrastructure that can only be satisfied through private investments. At amd.sigma we enjoy making the privatization process a success for all stakeholders.

Dr. Lutz Weisser *is founder and managing director of amd.sigma. Since 1997, he has not only specialized in strategic airport development, but is also a recognized expert in airport privatization.*

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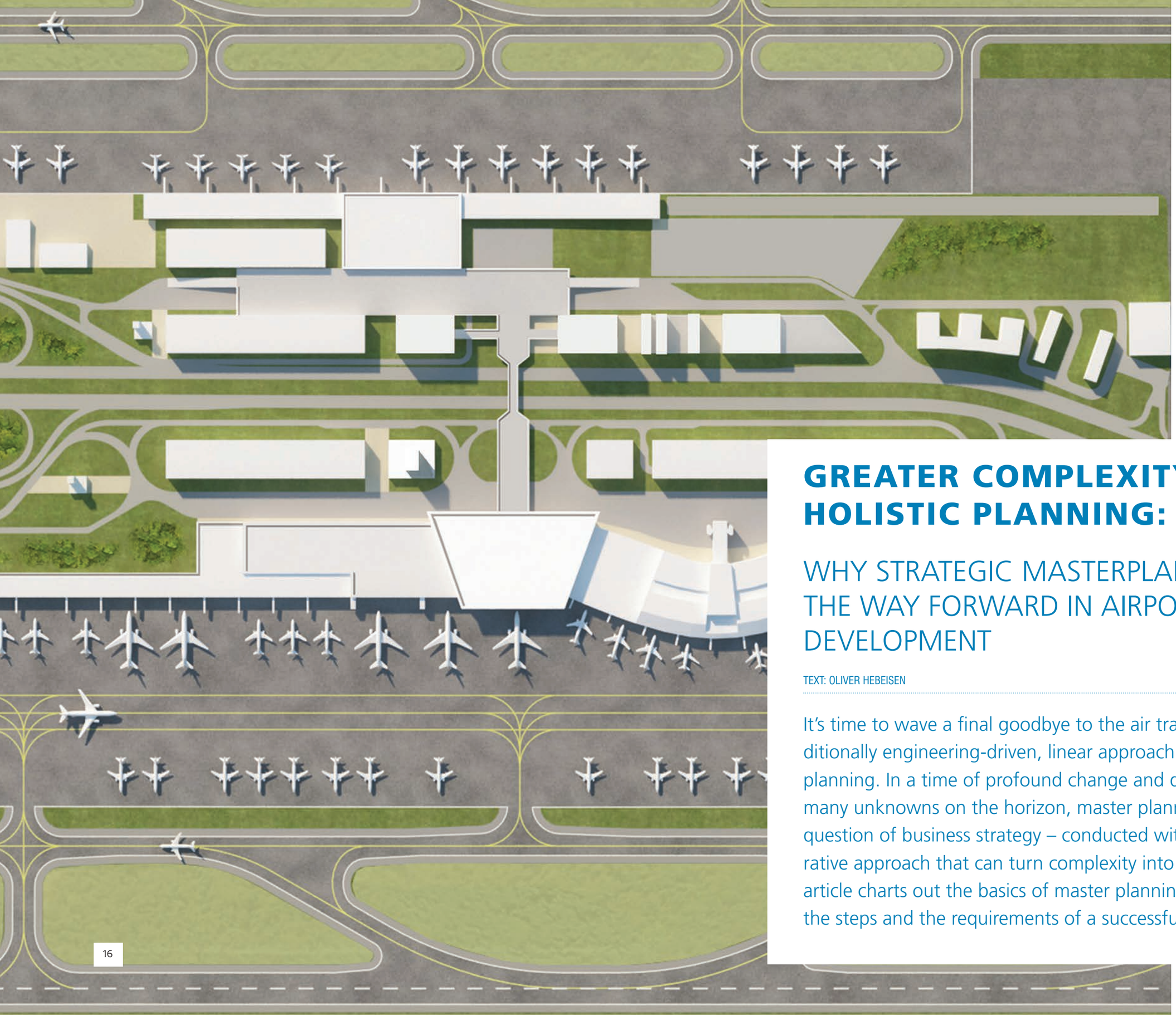


GREATER COMPLEXITY NEEDS HOLISTIC PLANNING:

WHY STRATEGIC MASTERPLANNING IS THE WAY FORWARD IN AIRPORT DEVELOPMENT

TEXT: OLIVER HEBEISEN

It's time to wave a final goodbye to the air travel industry's traditionally engineering-driven, linear approach to airport master planning. In a time of profound change and disruptions, with many unknowns on the horizon, master planning should be a question of business strategy – conducted with a holistic, iterative approach that can turn complexity into opportunity. This article charts out the basics of master planning, explaining both the steps and the requirements of a successful process.

For decades, the question of business growth in the airport industry seemed to solve itself. Demand for air travel grew continuously and many airport operators treated infrastructure planning as a simple linear equation: More potential passengers required more square footage of buildings and aprons, which in turn generated more potential revenue. The challenges of such master planning projects were believed to resemble those of other infrastructure expansion projects – requiring thorough planning, without a doubt, but certainly manageable.

That is perhaps why, since about 2010, I have seen so many clients become surprised and exasperated when they realized the full scope of their master plan project. If development strategy for airports is treated purely as an engineering challenge – that is, x more passengers times a predefined factor of check-in counters, etc. – this underestimates the complexities and conflicts inherent to this endeavor.

Despite continuous growth, air travel continues to be a highly volatile industry. This is indeed one of the industry's genuine paradoxes: The economic, political, and regulatory contexts in which airports do business are subject to rapid shifts, involving many unknowns. Infrastructure projects, on the other hand, are as long-term as it gets.

For one, government support – not just financial backing – is no longer a given and is dependent on current policy; some administrations might even actively seek to limit airport capacities, regardless of consumer demand. Nor is continuous infrastructure expansion an option when major airports start to run out of space, as in the case in Frankfurt and Dubai. Even for players with ample room for new developments, complex political and legal requirements are flanked by other vital business decisions – for example, whether to service budget airlines with a dedicated infrastructure, or how to include more commercial area. The potential outcomes point towards very different ways of harnessing revenue streams as part of long-term strategic planning.

Last but not least: In recent years, airports have been subject to the same disruptive innovations that impact other areas of life. Digitalization, for example, has resulted in sweeping changes – from the redundancy of checkin staff to drastic losses in parking revenues due to the car-sharing service Uber.

MASTERPLANNING – AN ITERATIVE, HOLISTIC PROCESS TO NAVIGATE TODAY'S COMPLEXITY

Airport development concerns investment decisions amounting to several million euros. But as more and variables and unknowns enter into the picture, decision-making needs to take into account much more than just the cost projections of infrastructure expansion. We believe that master planning needs to be treated as a central tool of business strategy – and, just like business strategy, it needs to take look at the big picture: evaluating potential options on the basis of economic, strategic, technical, and operational concerns. That is why we propose a holistic and iterative process, rather than the linear model that is common to engineering challenges.

Note that we say options, plural. Where traditional planning processes funnel resources into one "sacred idea", master planning always involves elaborating various scenarios. In these scenarios, we define as many variables and unknowns as possible and, importantly, do business-model testing for each of them. This way, we empower airport management to create opportunity out of complexity.

PROJECT STAGES AND SET UP

Our strategic master planning process takes around 8 – 12 months, on average, and is divided into six distinct phases. Each of these phases concludes with interim results and first decisions; these are presented to all stakeholders in a workshop setting so that everyone remains up-to-date on the progress.

PHASE 1: PROJECT SET UP

First, we familiarize ourselves with the project goals and requirements. To gain a better understanding of client needs and wishes, we arrange for individual, indepth sessions with key stakeholders. By presenting our preliminary findings to airport management, we arrive at a joint understanding of the project.

In the following kick-off workshop, involving both management and the extended stakeholder circle, we get everyone on board with the goals and process agreed on during the initial round of consultation with management. All participants are invited to share their priorities and expectations. Acting as facilitators, we set the stage for people to enter into the process in a collaborative spirit.

In our experience, approximately 50% of project stakeholders will not have been involved in a master planning process before. To get everyone on board, we bring hands-on examples from other master plans to our kick-off workshop, explaining both the process and the results. With the help of best-practice examples, we create a solution-focused mindset in the group.

TIMEFRAME: 2-4 weeks
OBJECTIVE: All master plan stakeholders gain a common understanding of the project goals and processes.

PHASE 2: ANALYSIS

In the analysis phase we look into four separate topics:

- Status quo of the airport
- Future capacity demand
- Futur trends in the industry
- Strategic options of the airport

The **analysis of the status quo** includes a summary of the airport's current infrastructure, e.g. gross floor areas of buildings, information about their age and condition. Additionally, we set up an overview of the existing airport capacity: number of aircraft stands, gates, check-in counters, etc. This list also contains information about existing process times. If the airport does not have information about process times, we arrange for them to be measured.
The **capacity demand analysis** is based on the traffic forecast for the airport. We break down the traffic numbers to analyze peak hour demand and calculate the future capacity demand figures for each process and for each of the intended development phases in the master plan. The difference between existing capacity and future demand per peak hour results in the capacity gap which must be solved by the master plan.

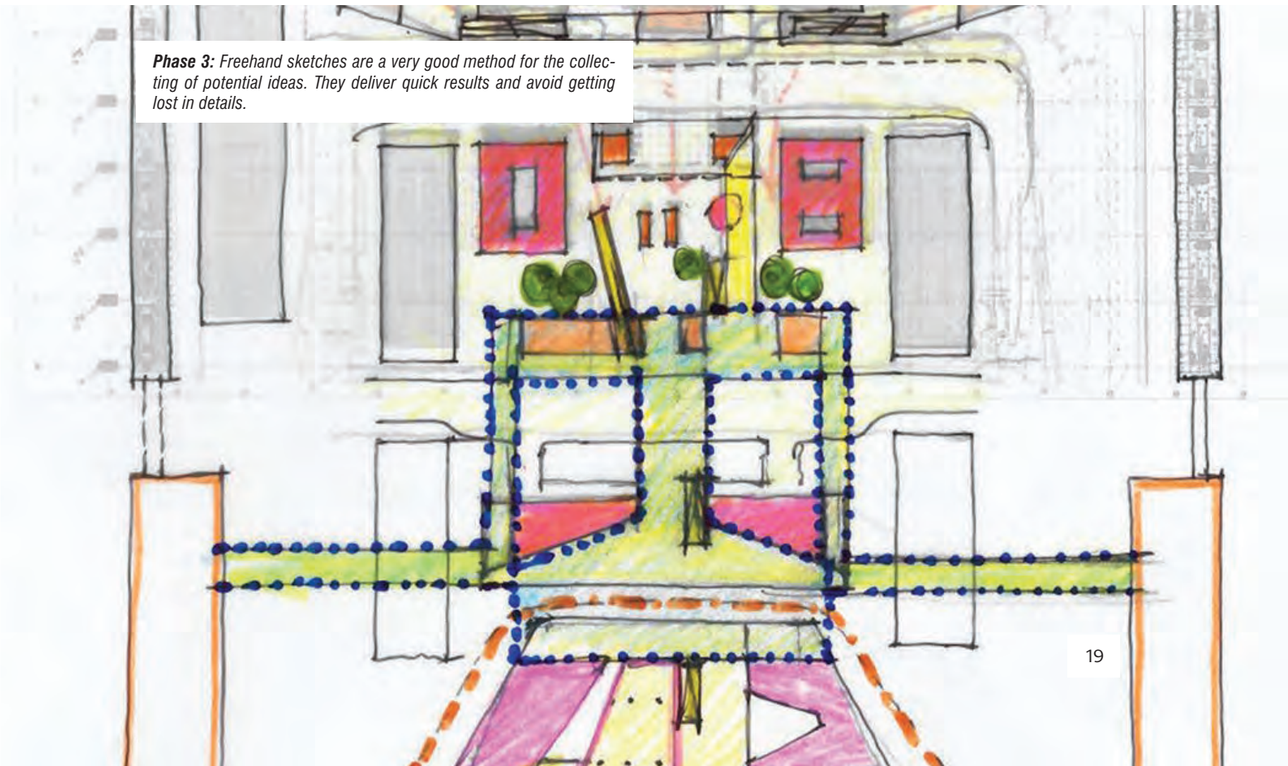
The aim of the **airport industry future trends** overview is to broaden the horizon of all stakeholders. It delivers the basis for a "what if" discussion: What would it mean for our airport if all cars were to be self-driving in 15 years? How would the infrastructure demands change? What would this mean for revenue?

Finally, we conduct a set of **strategic options** for the client, taking into account all of the information gained in the analysis phase. The result is presented and discussed with management and the key project members of the client in a strategy workshop.

TIMEFRAME: 1-2 month
OBJECTIVE: Gain a holistic understanding of all relevant framework conditions and the airport's future strategic options.

PHASE 3: COLLECTING POTENTIAL IDEAS

Having aligned goals and expectations with everyone during the first two project phases, we launch into the project's main phase of iterating solutions. We collect all potential ideas and solutions, even including scenarios that one might be tempted to dismiss



Phase 3: *Freehand sketches are a very good method for the collecting of potential ideas. They deliver quick results and avoid getting lost in details.*

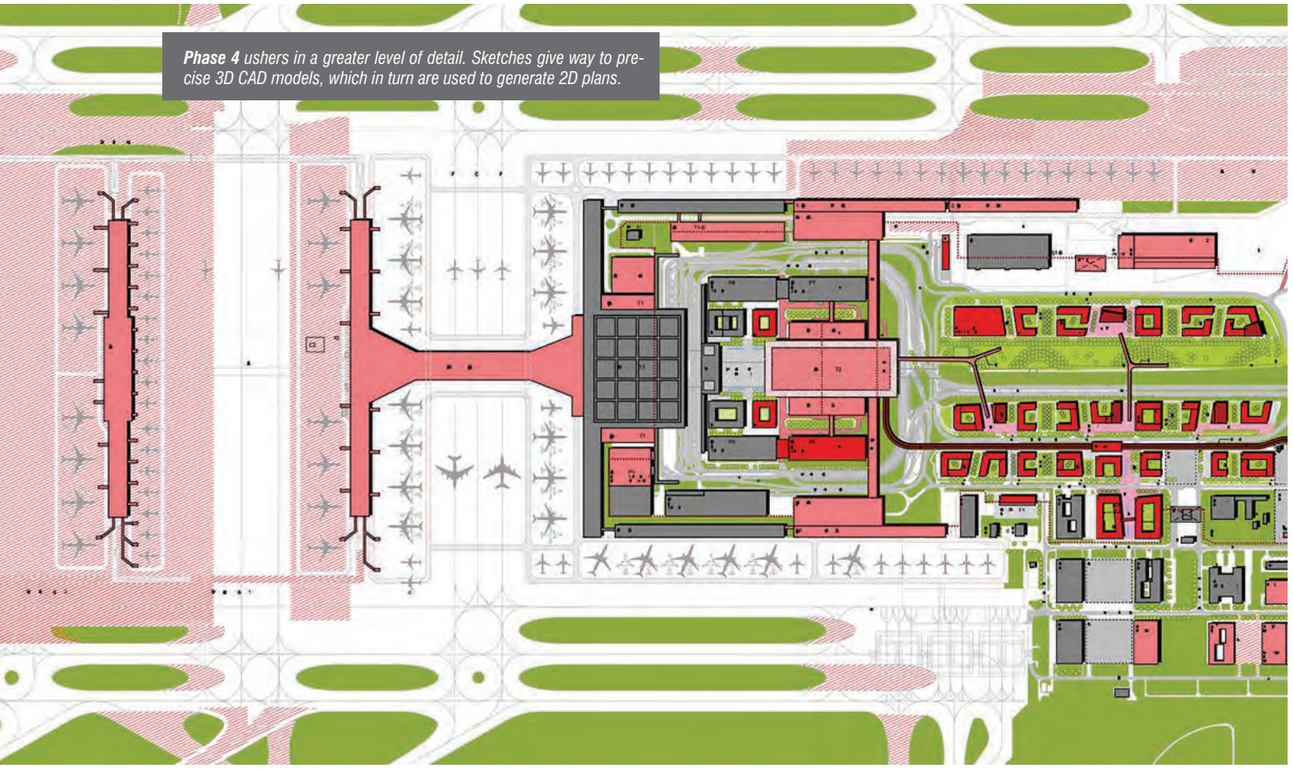
immediately. Project understanding and trajectory will evolve a lot over the process; it is important to keep an open mind. In a recent master plan project, for example, we sketched 15 ideas of how the airport could develop within the next 25 years. This list included solutions which seemed highly unrealistic or futuristic. However, for the decision process, it is important to discuss even these types of ideas. Demonstrating that "everything conceivable was considered" is crucial to achieving stakeholder agreement on three viable options at the end of this phase.

TIMEFRAME: 1 month
OBJECTIVE: Identify three ideas for further testing, picked from the full set of opportunities

responding capacity calculation model and a basic business plan model.

Developing, testing, and comparing several models at the same time is a vital advantage in the decision-making process, especially if backed up by economic projections. But this is also one of the key ways in which strategic master planning differs from linear, engineering-driven expansion plans: Master planning looks at a variety of possibilities from a business perspective and not just a technical standpoint.

We cannot stress enough how important it is to include such a businessplan model. Rating development options only with construction cost estimates simply does not deliver sufficient information for strategic decisions. Taking into account the revenue



***Phase 4** ushers in a greater level of detail. Sketches give way to precise 3D CAD models, which in turn are used to generate 2D plans.*

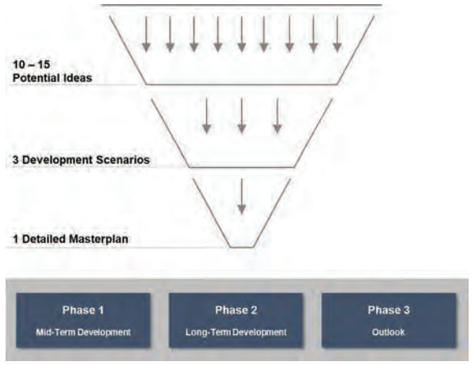
PHASE 4: ALTERNATIVE DEVELOPMENT SCENARIOS
The three most promising ideas are translated into comprehensive development scenarios. We prototype and quickly refine these business cases by testing their viability vis-à-vis internal/external variables and potential disruptors. Each scenario consists of a plan showing how the airport might look at the end of the master plan period, as well as a corside of a potential development will help stakeholders to find the best compromise between their infrastructure wish-list and what is feasible.

TIMEFRAME: 2-3 months
OBJECTIVE: Identify the best strategic model from the three prototyped scenarios, on the basis of a qualified evaluation.

PHASE 5: DETAILED MASTERPLAN
The solution that is found to be most viable is translated into clear, actionable steps and prepared for implementation. This includes:

- Plans, capacity models, and cost estimates for each developmental phase. There are typically three phases, each of which lasts from 5-10 years. The total outlook for a master plan is at least 20 years.
- Business plan model consisting of forecasted revenues, construction cost (CAPEX), and operational cost (OPEX).
- In larger projects, we often study initial terminal layouts in this phase of the master plan. As the future terminal expansion in the master plan only shows buildings as simple, non-descript boxes, drawings of the future terminal layout help us assess whether the assumed capacities and building sections can indeed be delivered.

TIMEFRAME: 2-3 month for detailed master plan and 1-2 month for a terminal concept layout
OBJECTIVE: Formulate the airport's comprehensive master plan



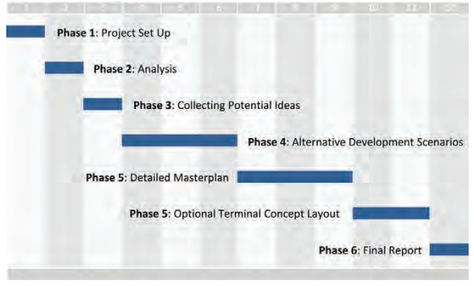
The final master plan is the result of an iterative process which leads from testing potential ideas, to developing and comparing three development scenarios, to one detailed master plan. The detailed master plan itself consists of 3-5 phases: the stages of future development.

PHASE 6: FINAL REPORT
The results of the master plan process are summarized in a final report. Usually, this consists of 3 separate documents with different levels of detail:

- Summary presentation = for communication to the board and external stakeholders, e.g airlines
- Summary report (30-50 pages) = for management
- Technical report: comprehensive documentation

The first key task of phase 6 is communicating the results to all internal and external parties. The second task is to draft an initial organizational concept for implementing the master plan results: project teams, budgets, time schedules. Very often, the board of the airport will only approve the master plan results if they understand exactly what this means from an organizational viewpoint.

TIMEFRAME: 1 month
OBJECTIVE: Communicate results to all internal and external parties. Draft an initial organizational concept for implementing the master plan results.



Overview of master plan phases, and timeframes per phase (in months)

Renderings are vital instruments of internal and external communication for masterplan results.

REQUIREMENTS FOR A SUCCESSFUL MASTER PLANNING PROCESS

Master planning is a highly adaptive framework; the specifics and content of various projects can differ quite profoundly. Nonetheless, our experience shows that there are several baseline requirements for the process to achieve its goal.

ENSURING THAT TOP MANAGEMENT ACTIVELY CHAMPIONS THE MASTER PLAN PROCESS

Top management needs to be willing to devote time and resources to the master planning process – ideally, they will happily do so, giving master planning the attention it deserves as the vehicle for their longer-term strategic goals. Over the course of the project, there are various ways for management to pull its weight. Firstly, it can help to keep up momentum among stakeholders: making sure the importance of the project is known to all, checking in regularly on progress, and creating "positive pressure" by requesting results. Equally important is decisiveness. Top managers need to make clear decisions – for as well as against possible paths or solutions – knowing that these will clash with some stakeholders' interests. Finally, top management is also responsible for information flow with supervisory boards, etc.

SEPARATING BUSINESS STRATEGY FROM DAILY OPERATIONS

In our experience, strategy processes like master planning can only reach ideal efficiency when they are handled separately from the operational side of things. In the early stage of the project, strategy topics should be discussed in cross-functional, full-day workshops with members of management present. Discussing these topics outside of day-to-day business ensures they receive the full attention required from all stakeholders. It also prevents them from getting lost, or time-boxed alongside countless other meetings. As the development process goes on, such day-to-day meetings should also be reduced to a minimum. This approach promotes transparency and open debate, and ensures that all project members have a shared frame of knowledge.

BUILDING A DEDICATED CORE TEAM

The core team is made up of 10-14 people: 5-7 representatives each from client and consultancy side. Needless to say, this presents some political difficulty. Some stakeholders are bound to feel excluded, but the priority should lie with bringing in representatives from the most important departments. Again, conflicts are likely to arise even when representatives are chosen – internal stakeholders from different departments might not have had to collaborate in such way and wonder what holistic strategy planning means for their future. However, as experienced facilitators, we are able to anticipate and mediate these concerns within an intelligent process. Additionally, we make sure that there is a feedback/communication protocol in place for stakeholders outside the core team and that people are kept engaged and "in the loop" thanks to regular updates.

FORMULATING CLEAR AGREEMENTS ON PROJECT SCOPE

Time and again, we come up against questions and issues within the process that aren't covered by the scope of work originally agreed upon. To avoid frustration on both sides, it is vital to agree at the outset which topics are to be covered by the master planning process. If economic viability is a priority, we will include a project business plan. Nonetheless, any iterative process requires both parties to remain flexible – to accept that exact deliverables may change as long as they still correspond to the original agreement. We aim to provide as holistic a scenario as possible: In our experience, breadth of content here is preferable to depth.

DEVISING THE RIGHT TIMEFRAME

Rushing through a master planning process is risky indeed. Holistic strategy development requires careful planning and analysis; after all, these decisions shape the airport's long-term future and carry a hefty price tag. However, it's important to note that avoiding or putting off decisions is no less precarious. The riskiest projects we personally have experienced were those with no deadline pressure whatsoever – if master planning drags on too long, project members will lose faith in the process, thus stalling a project that concerns nothing less than the future of the organization. And there is nothing that paralyzes an organization more than the lack of a future vision.

Oliver Hebeisen *works as a senior consultant at amd.sigma and as a senior airport planner for Munich Airport International. He has 30 years of experience in the planning of complex building projects. Since 2005, he has specialised in airport planning.*

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SUSTAINABILITY - OUR TASK FOR THE AIRPORTS OF THE FUTURE

OUR EXPERTS DR. LUTZ WEISSER, STEPHANIE GIL AND OLAF BÜNCK ARE FACING THIS CHALLENGE.

"I wouldn't say flying itself is wasteful. Airplanes are rather economical if you look at the distance-to-energy ratio."

CAN WE REALLY TALK ABOUT AIRPORT SUSTAINABILITY?

Stephanie Gil: The idea of airports being in contradiction with sustainability has to do with the fact that many of today's airports were planned 30 or 40 years ago. Back then, sustainability wasn't on the agenda. Nor was energy efficiency. We didn't have the technologies. But I think more and more airports are starting to include sustainable criteria in their agenda.

Olaf Bünck: Instead of framing it as a contradiction, we need to see it as a challenge. Yes, there's noise and air pollution at airports. And a lot of land being used. Those are the factors we're dealing with. New technologies like electric engines will help address these issues in the future. But they're not so easy to change in the short run.

HOW EXACTLY ARE AIRPORTS WASTEFUL OR INEFFICIENT?

OB: I wouldn't say flying itself is wasteful. Airplanes are rather economical if you look at the distance-to-energy ratio. However, at an airport, you have a high concentration of people, airplanes, waste, and energy consumption in one place. As Stephanie mentioned, many terminal buildings and airport buildings were built a few decades ago, so their energy efficiency is limited.

SG: There's also the fact that airport operations generate a lot of waste: food that passengers aren't eating, human waste, waste from liquids. All of these operations could be made more efficiently, so we could save resources and recycle more.

Dr. Lutz Weisser: It's also extremely interesting to consider the flip side: airports actually produce enormous amounts of energy. We're just not capturing it yet. There are multiple points of energy production. First, you literally have hundreds of thousands of 70-watt heaters passing through the airport each day – that's us. There's practically no terminal these days that needs to be heated. What they need is cooling – even JFK in winter for instance. Because where else do you have so many people together in a single building? They are generating a whole lot of energy and it needs to go somewhere.

ARE THERE CONCEPTS TO RECOVER THAT ENERGY?

LW: There are heat recovery concepts, but they are relatively inefficient. The biggest problem is the extreme peaks in demand. Every airport in Germany is bursting at the seams from 5:30 to 7:30 a.m. And then, suddenly, everyone disappears. And it's very expensive to balance out those peaks exclusively through heat recovery concepts.

HOW ELSE DO AIRPORTS GENERATE ENERGY?

LW: If you look at the vast concrete aprons where planes park, they are constantly exposed to solar radiation. It doesn't matter if you're in Oslo or in São Paulo, they heat up by solar radiation. All that energy is simply released into the atmosphere at night. But if you installed an inverse underfloor heating system, what you'd get is warm water – and the energy potential is mind-boggling according to the simulation we ran. But since airports don't need more heat, we're looking at what would happen if you used heat exchangers to compress all that heat to create cold air for terminals, and it appears to be an extremely promising approach. Our rollout customer is Berlin Airport, where we'll install three 5,000 m2 test fields and evaluate the results.

AND THAT'S A CONCEPT FROM AMD.SIGMA?

LW: Yes, it's a patented concept we call Solar Apron. If you look at solar radiation levels worldwide, there's an enormous amount of energy available daily. What we're trying to see is how much of that energy we can harvest. That's an aspect of sustainability we want to delve into even more – how to capture the massive quantities of energy generated by airports, whether actively or passively.

"But if you installed an inverse underfloor heating system, what you'd get is warm water – and the energy potential is mind-boggling according to the simulation we ran."

WHICH AIRPORTS ARE LEADING THE WAY IN TERMS OF SUSTAINABILITY?

OB: Looking at airport city development and master plan development, Helsinki, Oslo, Copenhagen are the leading examples of sustainable transformation. Oslo, for example, has a brand-new terminal building made entirely of wood. And they have a simple, yet effective way of cooling it. They collect snow in a huge reservoir in the winter and put a lid on it. Then it melts, very slowly, in the summer and cools the terminal. It's kind of a Flintstones approach – not very high-tech, but incredibly efficient. Then there's the lifecycle aspect: wood and other locally sourced materials will make it possible to dismantle the whole terminal at some point. So, they looked at every aspect of sustainability and long-term use, plus energy efficiency.

SHOULD WE BE WORKING ON MORE LOW-TECH APPROACHES?

LW: We believe that's a highly interesting aspect. A lot of these concepts are successful precisely because they're simple. Water pipes embedded in concrete – that's going to be a winner. But when you start taking ultra-complex A/C systems and factoring in all sorts of parameters, you build in room for failure. Especially in places where it's not always easy to find a skilled technician at a moment's notice.

DO YOU HAVE EXAMPLES OF SUSTAINABLE AIRPORTS OUTSIDE EUROPE?

OB: For a leading example in a warmer climate, we can look to Dakar in Senegal, which has the first major airport running entirely on solar energy. They even have an energy surplus and it's the only airport, to my knowledge, that relies completely on renewables. It's a great example of how sustainable approaches can be adapted to local conditions. Different climates require different solutions. There's no one-size-fits-all approach.

SHOULD ENERGY EFFICIENCY BE THE PRIMARY FOCUS OF SUSTAINABILITY INITIATIVES?

SG: Energy efficiency is a key factor. But it's crucial to understand that sustainability is a very complex topic that should include environmental aspects along with social and economic topics in order to make sense. Munich is a good example of a holistic sustainability strategy focusing not only on environmental aspects, but also on company management, employees and social aspects, and climate protection.

WHAT ARE THE INTERNATIONAL STANDARDS FOR AIRPORT SUSTAINABILITY?

SG: First of all, we can look to the global strategy laid out in the UN Sustainable Development Goals (SDGs), which focus on essential aspects such as quality of life and the efficient use of our planet's resources. International standards are drafted in alignment with these global goals. One widespread standard is the Airport Carbon Accreditation (ACA) supported by the Airports Council International. Then we have standards for buildings such as the DGNB (German Sustainable Building Council) in Germany. Internationally, we have well-known standards like LEED or

WELL, which focus on health, well-being and aspects of the user experience in buildings. Then there's BREEAM (Building Research Establishment Environmental Assessment Methodology). These are the primary standards and benchmarks in the industry.

HOW DO YOU DECIDE WHICH STANDARDS TO APPLY?

SG: Usually, it's a long process. We sit down with our clients and evaluate their commitment, their goals and the value the standard would bring: would it be a good fit and truly serve their needs and the airport's global strategy?

More and more airports are choosing the ACA because it provides a solid compromise between feasibility and the SDGs. But these standards aren't mandatory. Each airport makes its own decision in terms of addressing and reducing their carbon emissions. I believe that with the time the compliance with international sustainability standards will be more a requirement rather than a choice.

"You can't build very energy-efficient buildings on a shoestring budget."

DO YOU NOTICE DIFFERENCES BETWEEN PRIVATE AND PUBLIC OPERATORS?

LW: Privatization projects are a central component of our work. In Germany, we have a very high concentration of so-called multi-airport operators – Munich Airport, Fraport, Avialliance (formerly Hochtief Airport), Zurich Airport, Vienna Airport – who together own around 50 or more assets worldwide. And when you look those global assets, like JFK or Porto Seguro, these operators are applying the same rigorous sustainability standards that apply in Germany, such as compliance requirements and even more specific aspects like Munich's goal of becoming carbon-neutral by 2030. They comply with international and local rules, but in most cases, their own standards are even stricter.

WHAT ARE THE INCENTIVES TO ADOPT THOSE STRICTER STANDARDS?

LW: It's a question of conscience. You don't do it for the money. "Flight shame" is a topic that affects all of us in a big way.

OB: Airlines also use carbon neutrality as a selling point, and it's a magnet for consumers. So, indirectly, it's good for marketing. But as Lutz said, it's basically your conscience: What kind of airport do you want to have? It always depends on who is running the airport – and politics. Because at this point, the regulations are not entirely mandatory.

WHAT ARE SOME OF THE CURRENT OBSTACLES TO SUSTAINABLE DEVELOPMENT?

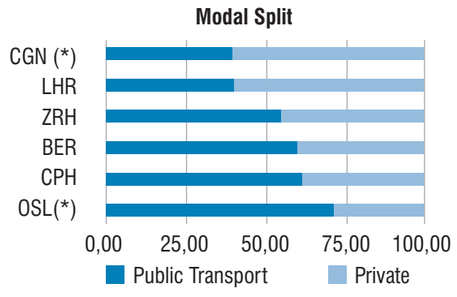
OB: If you want to do a complete overhaul of a 30-year-old terminal, you almost have to build a new building. And the new ones are often constructed under a lot of economic pressure. There's not a lot of money, because there are so many low-cost airlines right now. You can't build very energy-efficient buildings on a shoestring budget. If you look at airports built by low-cost airlines, they're more or less boxes. The most you can do in terms of sustainability is plan a structure that can be easily dismantled for reuse. It's very difficult in this environment to get through with long-lasting, sustainable ideas.

WHERE DO YOU SEE POTENTIAL FOR SUSTAINABLE AIRPORT DEVELOPMENT?

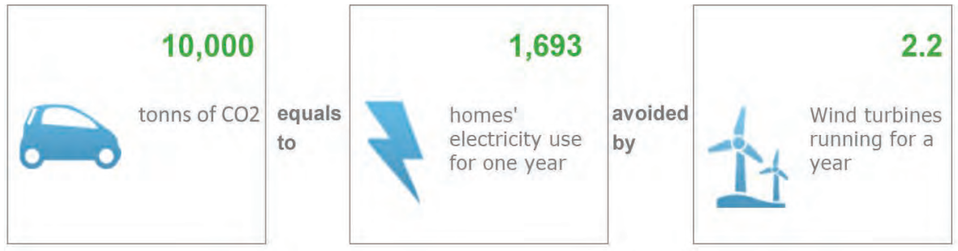
SG: After aircraft movement, ground access is the second biggest source of carbon emissions at airports – accounting for 24 percent. Ground access basically means which mode of transportation passengers choose to get to the airport. In other words, whether they drive or take public transportation, if available. All those individual choices add up, and we can assess their impact through the modal split.

IS IMPROVING MODAL SPLIT A GOAL YOU WORK ON WITH YOUR CLIENTS?

SG: We recently did a hypothetical calculation to understand the impact of different modal splits. At Cologne-Bonn Airport, for example, less than 40 percent of passengers arrive by public transportation. We calculated what would happen if the current modal split was like the one of Copenhagen, where 70 percent of passengers arrive by public transport. The results were stunning: over one year, that 30 percent shift would save 10,000 tons of CO2 per year. That is equivalent to the electricity consumption of 1700 households for an entire year. That illustrates the relevance of the modal split: it is a highly strategic topic that should be a factor into management decisions.



Modal Split of European Airports.
Source: Own graphic with information from Airports' annual reports



10,000 tons of CO2 per year equivalence. Source: Own calculations and the equivalencies from the Environmental Protection Agency (EPA) calculator.

What have been some other learnings from your projects?

Olaf: Adapting sustainability approaches to regions where the topic is still relatively new can be challenging. It's a very steep learning curve for both the client and us. In Quito, for example, we developed a concept that goes far beyond master planning. We incorporated several urban design principles. Our idea was to the re-develop parking surfaces in order to create public and private areas with added value, prioritizing the pedestrian areas and the public transport, we wanted to have a central square or plaza where people can relax and enjoy quality time.

"You really have to work with clients to understand their future visions, too – and not just confront them with a flashy magazine article that says, 'in 5 years we'll all be in flying taxis.'"

WHAT ABOUT EXCITING PROSPECTS FOR MORE SUSTAINABLE AVIATION IN THE FUTURE?

OB: One very interesting development is electric vertical take-off and landing (eVTOL) aircraft. These aircraft make taking off and landing significantly shorter. People still aren't sure whether it's more of an airplane or a flying car. Which means car manufacturers are getting into the idea, but also companies like Airbus. We're not quite sure which direction it will take and whether it will be based at an airport or perhaps somewhere else because you won't need a runway anymore.

ARE THESE FUTURE VISIONS ALREADY IMPACTING HOW YOU PLAN?

OB: If you want an official stamp that says you can build it, you're kind of stuck in the present. But on the other hand, if you want to create a master plan with a 20- or even 40-year outlook, there's always an element of science fiction. If there's already a prototype today, it will most likely be commercially viable within a decade or so. Then you have to consider, what's the most rational and likely scenario of how this is going to play out? Do your reading, go to exhibitions, see what manufacturers have in the drawer. That will give you an idea of how things might look in 10 or 15 years.

HOW DO YOU COMMUNICATE THESE SCENARIOS TO CLIENTS?

OB: You really have to work with clients to understand their future visions, too – and not just confront them with a flashy magazine article that says, 'in 5 years we'll all be in flying taxis.' Which is also wrong. As master planners, we need to be flexible enough to allow for those developments. Otherwise, in 10 years, our plans will turn out to be useless. Instead, we need strategies that enable us to make future changes without driving up costs. We always need to keep one eye on the present and the other on the future.

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WHY DO WE USE BUILDING INFORMATION MODELING?

TEXT: PEDRO OLIVEIRA

BIM is set to transform the planning landscape. With more and more countries committing to the software, BIM will mean new laws and disruptive shifts in the work of planners. We discuss the benefits and pitfalls – as well as our own strategies for working with this next-generation modeling solution.

The use of building information modeling (BIM) is probably the most significant development in the architecture, engineering, and construction (AEC) industry in the past 15 years. Since traditional computer-aided design (CAD) tools already transformed the work of planners back in the 1990s, it is only logical to ask what BIM is adding to the big picture. The short answer is that while traditional CAD tools are used for drafting, BIM encompasses even more facets: It is (at minimum) three-dimensional and offers an almost infinite array of tools to structure data in a digital model. Beyond this extra depth, it is collaboration software – a central tool that planners can use to work on the same model. This single source of truth enhances communication among specialists while improving certainty regarding coordination and costs.

Given these advantages, clients, and contractors often see BIM as a risk-mitigation tool and a solution that focuses on construction and coordinating specialists – things that usually lie outside of our scope. So why are we using it at amd. sigma? That's the question we'll be exploring here.

FOUR CLEAR ADVANTAGES OF BIM

An airport is a fascinating and complex building. It is the nexus of a network of organizational, financial, political, and social vectors – and ideally structured around a vision and a strategy. Unfortunately, however, this is often not the case. There tends to be a culture of short-termism around large built assets, which often represent a cumulative history of quick fixes to immediate problems. Over time, t he big picture gets lost.

Our goal is to provide tangible visions which support our clients in making informed decisions. In light of this, we see four major advantages in BIM.

1. MANAGING COMPLEXITY

Considering the wealth of information that goes into airports – surveys, existing facilities, future projects – our central models allow us to record and manage such diverse data in a very clear, reliable way. This first step is crucial for evaluating the asset. Complex requirements are precisely what led planners at Heathrow Airport to pioneer the use of RUCAPS, the predecessor of BIM, in 1986.

2. IMPROVED AND ENHANCED COMMUNICATION

The centralized structure of BIM enables our team to work simultaneously on the same model, thus decreasing the chances of mistakes arising from miscommunication between team members. The interaction from/to our BIM models has also proven to be valuable to our usual partners, whether they are planning airside or baggage-handling systems, as well as for producing high-quality renderings.

3. VISUALIZATION

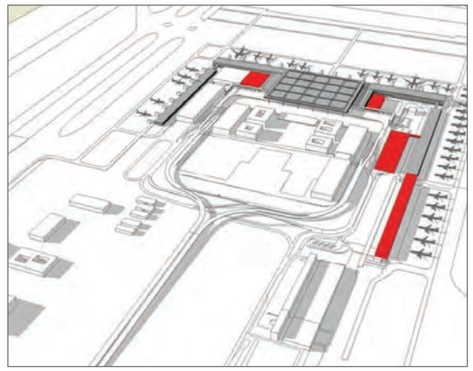
We usually have very little time to present scenarios to decision makers. Luckily, the mix of 2D conventional graphics (plans, sections) and 3D views provided by BIM streamlines the communication of each alternative. During discussions about a plan or section, misunderstandings can arise among even the most experienced architects and engineers. This problem is compounded when other specialists (e.g. investors and managers) join the conversation. And with a master plan, where the scale is quite unfamiliar to most people and highly abstract, the challenge of visualization becomes even more evident. BIM helps avoid all of these pitfalls.

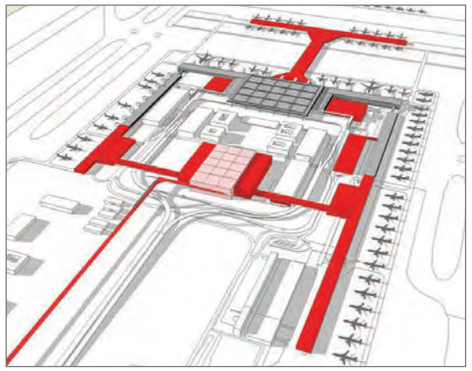
4. DEPTH OF INFORMATION

With BIM, the additional fourth dimension of structured data (net/gross floor areas, phasing, cost estimation and design options) provides a systematic foundation for stakeholders to get a feel for each scenario. Whether we are dealing with a macro-scale project for an airport city or planning a detailed user requirements specification, we use BIM's parametric tools to extract the relevant data for each project and/or stakeholder.

DIFFERENT SCOPES, ONE TOOL

As strategic advisors, we usually cover projects ranging from master plans to building concept development. Navigating such complex projects is as fascinating as it is difficult. To deal with complexity in our work and mitigate inherent uncertainties, we operate between two major lines of action: the expertise of our team on one hand and a systematic tool such as BIM on the other. Open and systematic dialogue between these 2 vectors streamlines the added value for our clients, as we will see in the examples below.





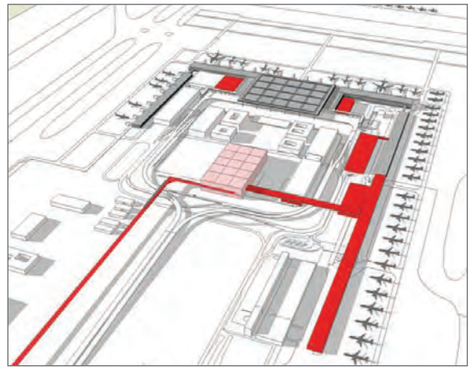


Image 1. MASTERPLAN: BER 2040. The 3D models above were established as the basis not only to visualize the development of the BER Campus over time but also to extract data to feed the CAPEX calculation.

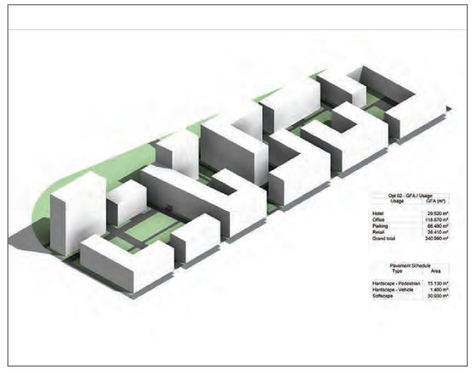


Image 2. Airport city development: Various urban concepts were discussed with the client, with variations revolving around parameters such as gross floor area, building usage ratios, soil types (hardscape vs. softscape), and CAPEX calculation, all within the same model.

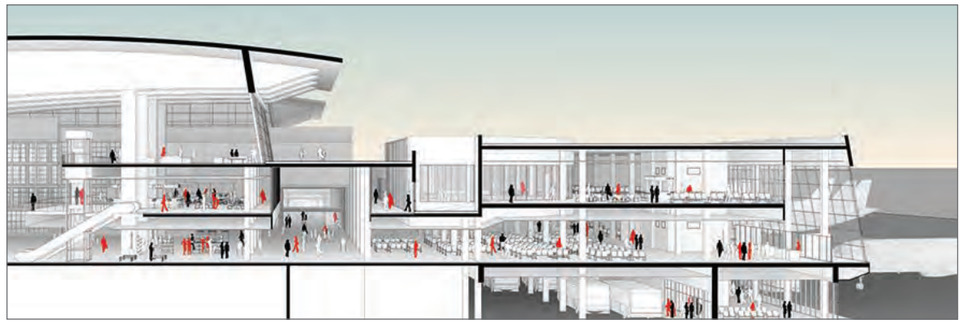


Image 3. Building layout planning: Alternative options were developed and iteratively discussed with the client, with BIM models used as the basis for visualization and data extraction. This approach helped us quickly convey the building concept and flows, supported by live key data such as gross floor area, net floor area (i.e. floor space per user) and processing numbers (check-in, security lines, baggage claim length/number, and passport control, for example).

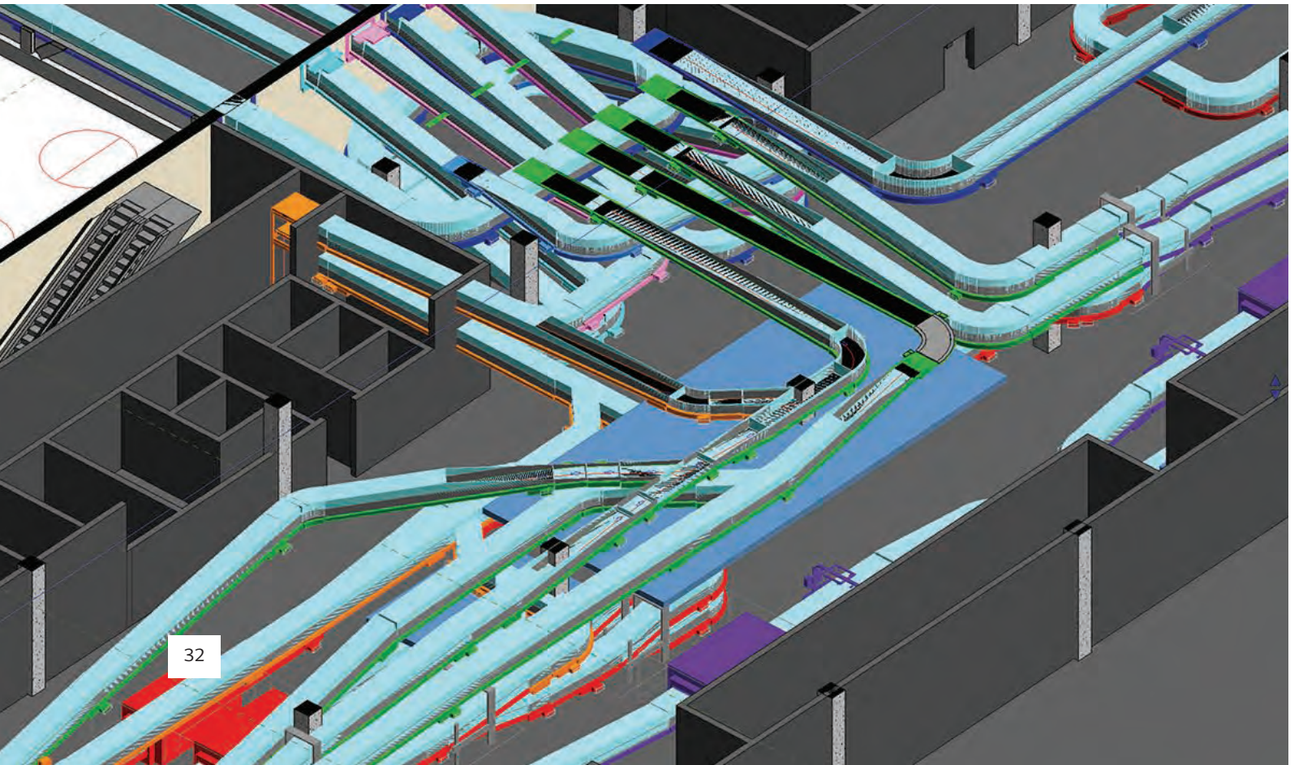


Image 4. Improved collaboration between stakeholders: These images exemplify the integration of the complex geometries for a baggage handling system (BHS) and allow the identification of bottlenecks and clashes, making the project development more agile.

CAD TO BIM: A SEAMLESS TRANSITION?

As one might expect, the switch to an entirely new visualization and collaboration method also involves a number of challenges. For teams, the impact tends to be very high, a fact which demands significant internal investments. In our experience, BIM requires an unusually deep dive into detailed considerations during early stages of concept design. At the moment, our team mitigates this demand for early depth with two strategies. One is to start with a minimum set-up: a small number of elements used for each model. After identifying the brick-and-mortar of our usual scope, we develop a working template that prevents team members from getting distracted and losing time on overly detailed modeling. Our second strategy is to take a step back and do more planning by free-hand sketching before we jump into the software. Because BIM software offers little leeway in how models can be structured and oriented, we have to plan before building the model.

On the whole, the shift from traditional CAD to BIM is not an easy transition. Having gone through this myself a few years ago, I know that a certain level of frustration needs to be overcome. Personally, it helps me to remind myself of the added value BIM allows us to offer our clients. At amd.sigma we have implemented regular in-house training for our staff which has been in place for almost a year. The results are satisfying – especially considering the heterogeneous backgrounds of our staff and the learning curve for each team member.

EXTERNAL SIGNS AND FUTURE COMMITMENTS

The current status of BIM varies quite widely around the world. In the UK, USA, and Australia, its adoption has already reached a very mature stage (even in legal terms). Other markets are still testing or have yet to adopt. Nevertheless, we are now witnessing pressure from both the market and legislators. Germany, for example, has committed to a mandatory BIM requirement for all infrastructure and large-scale projects, effective as of 2020.

Although the current scope of our activities is categorized as a preparation stage, i.e. we support the client prior to all the official approvals and permits, we see BIM as a potentially valuable model and basis for the official planning stages that follow. And obviously, we want to hit the ground running once these changes take effect and join the early adopters on a global scale.

Pedro Oliveira *is Senior Consultant at amd.sigma and has over 10 years of experience as an architect. He is amd.sigma´s expert for Autodesk revit BIM software.*

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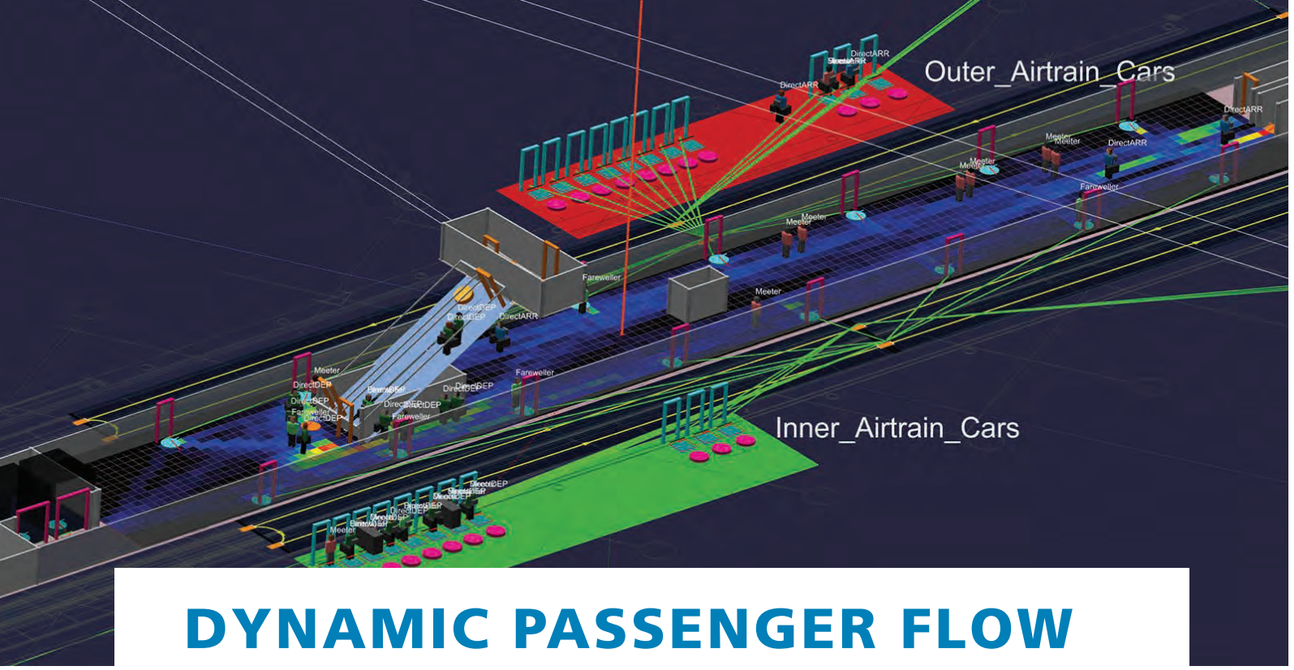

DYNAMIC PASSENGER FLOW SIMULATION WITH CAST-TERMINAL

AMD.SIGMA EXTENDS ITS SERVICE PORTFOLIO

TEXT: ROBERT BRINKMANN

Where should check-in counters be located? How can passenger flows in the terminal be better managed? And what process or infrastructure adjustments will prevent passengers from queueing excessively at security checkpoints? The dynamic simulation software „CAST-Terminal“ provides answers to questions like these and thus allows the optimization of operational processes at airports. Robert Brinkmann, expert in capacity planning, explains why amd.sigma uses the software for terminal planning.

Airlines and airports are under increasing pressure to cut costs due to strong competition and rising production costs. The expansion of airport infrastructure is investment-intensive and in many places only possible to a limited extent due to a lack of open spaces. On the other hand, it is comparatively cost saving to optimize processes and thus exploit existing potential. However, this first requires a precise analysis of existing capacities for current and future passenger loads. Only on this basis can it be assessed, on whether future traffic can be mapped in the existing infrastructure.

STATIC VERSUS DYNAMIC SIMULATION

Static capacity models and considerations that focus on selected points in time such as peak loads quickly reach their limits.

This is because these models only provide snapshots and usually have too little depth of analysis to answer questions about a system with time dependency. Dynamic simulation models are different: they make it possible to display and analyze terminal processes within defined time periods and intervals, for example changes in passenger loads over selected days.

The dynamic simulation software CAST-Terminal, part of the simulation environment CAST, offers the possibility of simulating variants in terminal infrastructure as well as alternative process sequences, making optimization potentials visible.

By modeling terminal layouts, processes and passenger behavior, detailed passenger flows and the resulting loads on the infrastructure can be examined.

A demand assessment can also include the investigation and optimization of various allocation scenarios, such as check-in counters or baggage conveyors. Numerous analysis options make it possible to determine whether the desired quality standards, such as maximum waiting time or space availability per passenger, are met or not.

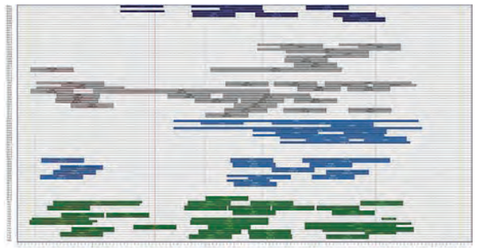

Figure 2: Check In Allocation Scenario Analysis

CAST-TERMINAL EXPANDS SERVICE PORTFOLIO OF AMD.SIGMA

Since the beginning of 2020 amd.sigma has been successfully using dynamic simulation, thus expanding its own range of services in the field of dynamic demand determination, the creation and analysis of allocation scenarios as well as dynamic level of service analysis (LoS) and passenger flow optimization.

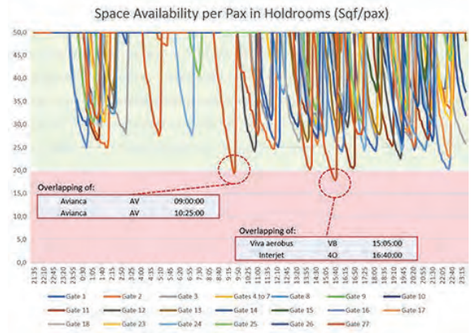

Figure 3: LoS Analysis for Gate Holdrooms

Robert Brinkmann is Senior Consultant with more than six years of professional experience. Master planner and specialist for capacity planning in terminal processes, airside operations, and CAPEX calculations.

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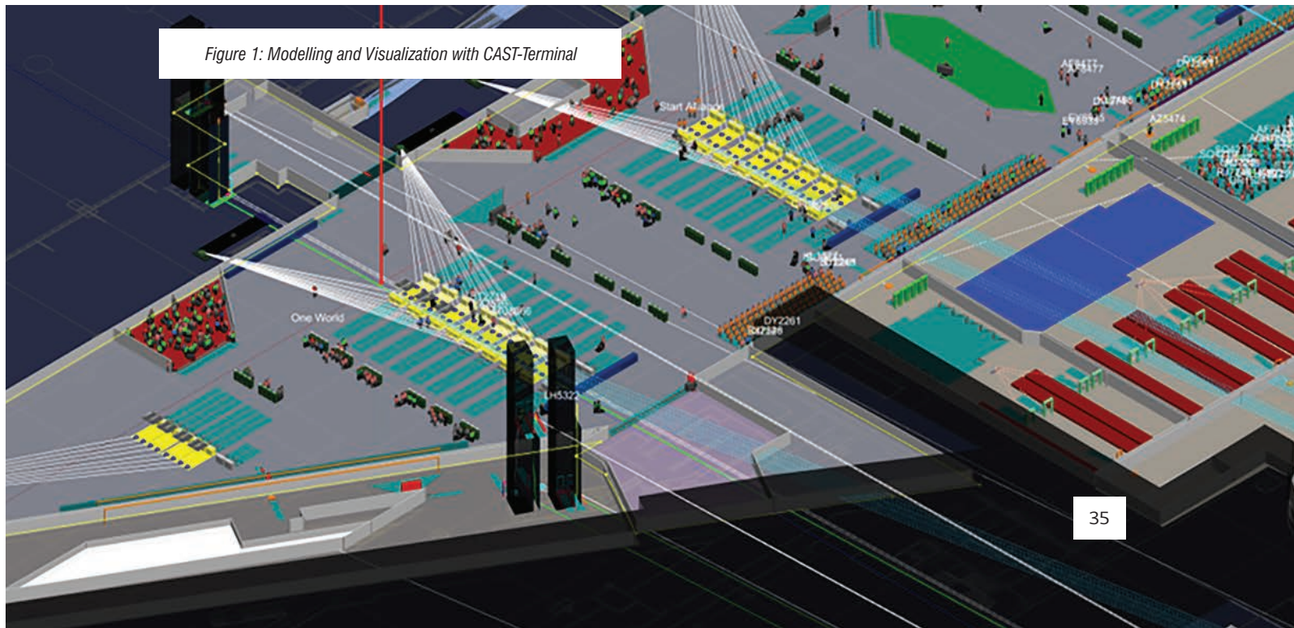

Figure 1: Modelling and Visualization with CAST-Terminal

WHAT WE DO

amd.sigma specializes in strategic airport development. Our senior consultants wield decades of experience to support both private investors and public authorities. Thanks to our deep industry expertise and holistic approach, we empower our clients to build and evolve complex built assets – while balancing building requirements with the needs of users and financial targets.

AIRPORT MASTERPLANNING

We have a highly process-oriented approach to master planning. Our consultants design a development plan based on the needs of various stakeholders. Several possible solutions are outlined so our clients can make an informed decision.

SERVICES

- Capacity analysis and estimation
- Master planning
- Support with obtaining planning and building permits
  Development studies and comparison of alternative planning approaches

PROJECT DEVELOPMENT FOR AIRPORT BUILDINGS

Project development results in a finalized concept for a construction project that is ready for handover to architects. We analyze and present multiple options for floor plans and building locations. Planning and technical requirements and the preparation of cost estimates and development timelines round off our services.

SERVICES

- Analysis of project parameters
- Layout planning and comparison of alternative options
- Coordination of internal development processes
- Analyzing and integrating user requirements
- Compliance with building regulations and management of technical requirements
- Cost estimates and scheduling

AIRPORT PRIVATIZATION

amd.sigma has partnered with clients on development projects for both publicly and privately operated airports around the world. We draw on this expertise to offer the complete range of services to manage the privatization process, which we offer either individually or in combination.

SERVICES

- Bid management
- Due diligence
- Coordination of external experts
- Masterplanning
- CAPEX and OPEX Analysis
- Business planning

REFERENCES

Abu Dhabi
Almaty
Amman
Asaba
Ashgabat
Bahrain
Bangalore
Beirut
Belo Horizonte
Berlin
Bogota
Brazilia
Chania
Cologne
Corfu
Doha
Fortaleza
Frankfurt
Geneva
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