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Building Capacity in geodesign: Alternative futures for Al Ain, Abu Dhabi, United Arab Emirates in 2050

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Executive summary

Geodesign changes geography by design. It is a method which tightly couples the creation and synthesis of diagrammatic policy and project proposals for future change. Its impact simulations are informed by geographic contexts and by system thinking rather than shape thinking. It is normally supported by digital technology, meaning that geodesign must be an organized process. It needs to be collaborative and cannot be efficient or effective if conducted in separate and sequential bureaucratic “silos”. Geodesign is most useful at the beginning stages of strategic change, when there is a simultaneous need to consider all aspects of change: the “WHY?” questions, the “HOW?” questions and the “WHAT, WHERE and WHEN? questions. A two-day geodesign workshop on the future of Al Ain, UAE, was organized and led by faculty from the University of the United Arab Emirates and the Centre for Advanced Spatial Analysis of University College London. The digital geodesign tools allowed for a collaborative negotiated geodesign based on diagrams of policies and projects. If successful, geodesign can produce a strategic outcome which indicates that “It can be…or might be… something like this”.

Introduction

Geodesign changes geography by design. It is a method which tightly couples the creation and synthesis of diagrammatic policy and project proposals for future change. Its impact simulations are informed by geographic contexts and by system thinking rather than shape thinking (Steinitz, 2012; Batty, 2013). Normally supported by digital technology, geodesign must be based in an organized process, such as a framework (Rowe, 1987; Rowe, 2017). It must be collaborative and cannot be effective if conducted in separate bureaucratic “silos” (Pettit et al., 2019). Geodesign is most useful at the beginning stages of strategic change, when there is a simultaneous need to consider all aspects of change, such as: the “WHY?” questions, the “HOW?” questions and the “WHAT, WHERE and WHEN? questions (figure 1) (Steinitz, 1990; Steinitz, 2012; Hollstein, 2019).

What makes geodesign interesting and innovative is that the process is geared towards negotiation among different stakeholders seeking to strike a compromise. It attempts to shift the paradigm from a zero-sum game to a win-win situation. If successful, geodesign can produce an outcome which indicates that “It can be…or might be… something like this”.

Geodesign is best accomplished in a face-to face workshop setting, albeit in these times, participants will likely engage via an online platform (Ballal & Steinitz, 2015). It can be supported through efficient digital tools (Ballal, 2015; Ballal, 2020) which enable a collaboratively negotiated consensus based on diagrams of policies and projects.

The International Geodesign Collaboration (IGC) https://www.igc-geodesign.org was created in 2018, as a network of academics, practitioners, universities and NGOs who agreed to collaborate to create scenario-driven designs for local-to-regional scale study areas to address future changes. Participation in the network is open and at no cost.

Figure 1: The member university teams in the International Geodesign Collaboration.

Currently more than 150 participating university teams and NGO's in 50 countries are collaborating, to educate an estimated 10,000 people who will be globally leading and working on our largest planning challenges.

In November 2019 the faculty from the Geography and Urban Sustainability Department at University of the UAE and the Centre for Advanced Spatial Analysis (CASA) of University College London (UCL) organized and led a two-day Al Ain geodesign workshop. The workshop was conducted with adherence to the principles from IGC to study of possible futures for the city of Al Ain given an approximate doubling of Emirati and expat population, from 800,000 to 1,600,000 by 2050.

The workshop was guided in part by the by principles established by Sheik Zayed. These policies were established for Plan Al Ain 2030 and were to be followed by the workshop participants:

- Protect the cultural and heritage buildings and landscapes
- Protect nature and develop according to environmental conditions
- Apply sustainable infrastructure technology for managing energy and water
- Maintain strict height controls on new buildings, to no more than four floors
- Shape new growth by mixed-use development
- Develop in districts with a clear desert edge
- Develop a park system for outdoor use
- Develop pedestrian-friendly centres

Following the assessment of the UAE demographic projections, which forecast an, a general doubling of all the system-developments was assumed for the study region, as the basis for the geodesign workshop.

On geodesign

Geodesign is organized by a systems-oriented framework (Steinitz 2012), which asks and answers six relevant questions that apply to any geodesign circumstance (figure 2).

1. How should the state of the territory be described in content, space and time? This question is answered by representation models, the data which the study relies upon.
2. How does the territory operate? What are the functional and structural relationships among its elements? This question is answered by process models which provide information for the several analyses that make up the content of the study.
3. Is the current state of the territory working well? This question is answered by evaluation models, which are dependent upon cultural knowledge of the decision-making stakeholders.
4. How might the territory be altered – by what policies and actions, where and when? This question is answered by the change models which will be tested in this research and contain additional data.
5. What difference might the changes cause? This question is answered by impact models, which contain information produced by the process models under changed conditions.
6. How should the territory be changed? This question is answered by decision models, which, like the evaluation models, are dependent upon the cultural knowledge of the decision-making responsibilities.

Over the course of a geodesign study, each of the six questions and its subsidiary questions are asked three times: first to define the context and scope of the work (the WHY? questions); second to identify the methods of study (the HOW? questions), and third, to implement the study method (the WHAT, WHERE and WHEN? questions).

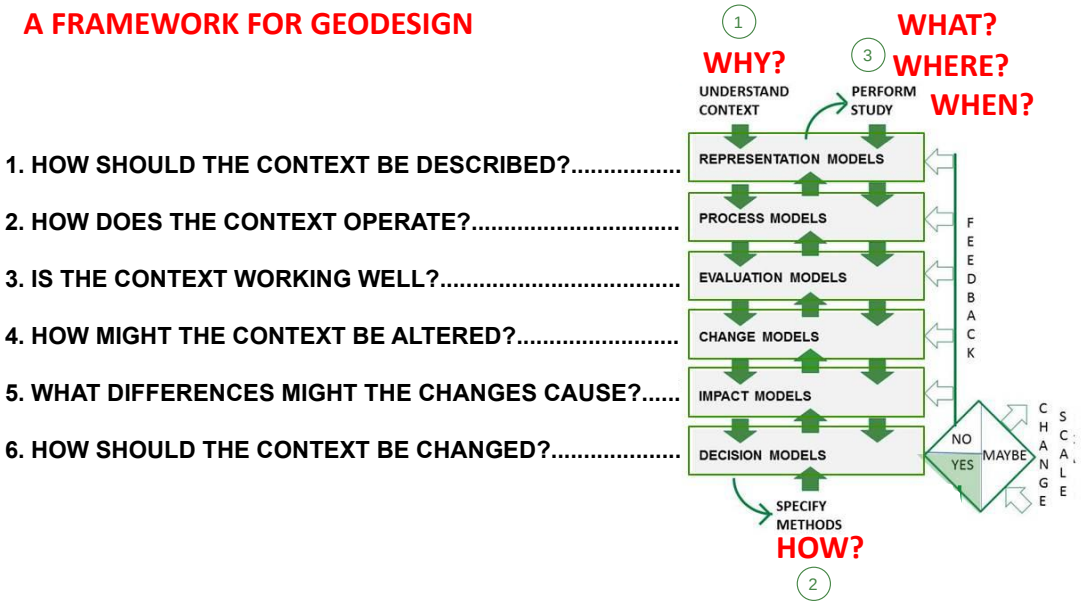

Figure 2: Six questions must be asked and answered for any geodesign study. (Steinitz, 1990; Steinitz, 2012)

Geodesign is never a linear process, with the framework potentially being the basis of a very complex study. Regardless of complexity, the same questions are posed again and again. However, the models, their methods, and their answers vary according to the context in which they are used.

The IGC strategy incorporates this approach by requiring adherence to common scenarios and time frames, nomenclatures and processes to assessment of their achievement in advancing the UNDP's Sustainable Development Goals (SDGs) (figure 3).

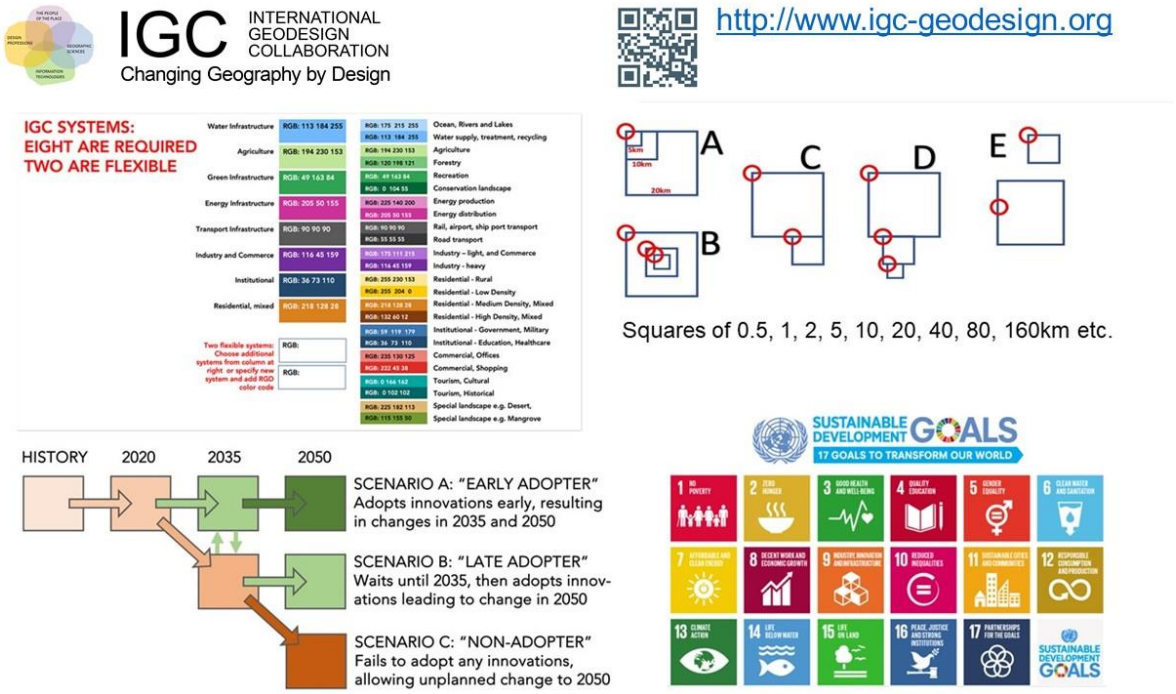

Figure 3: The IGC common systems, scenario and time frames, square study areas and UN Sustainable Development Goals

The study area – Al Ain

Al Ain (literally The Spring) is a city in the Emirate of Abu Dhabi, in the United Arab Emirates (figure 4). Al Ain is an ancient crossroads. For at least 5000 years it has offered a pleasant cool respite from the heat of the surrounding desert. It is a Garden City of lush oases fed by an ancient irrigation system known as falaj. Al Ain is the largest inland UAE city and an important service centre for a wide area extending into Oman. The freeways connecting Al-Ain, Abu Dhabi, and Dubai form a geographic triangle in the country, with each city being roughly 130 kilometres from the other two.

Figure 4: The Al AIN region study area in Abu Dhabi, United Arab Emirates

With a population of around 800,000, it has the highest proportion of Emirati nationals (30.8%) in the country, though the majority of its residents are expatriates. Al Ain has a hot desert climate featuring long, scorching summers and mild winters (figure 5).

Figure 5: Scenes in Al Ain in 2019.

Al Ain was where Sheikh Zayed bin Sultan Al Nahyan (1918 – 2004), the founder of the United Arab Emirates, spent much of his life before becoming the Ruler of the Emirate of Abu Dhabi in 1966 (figure 6).

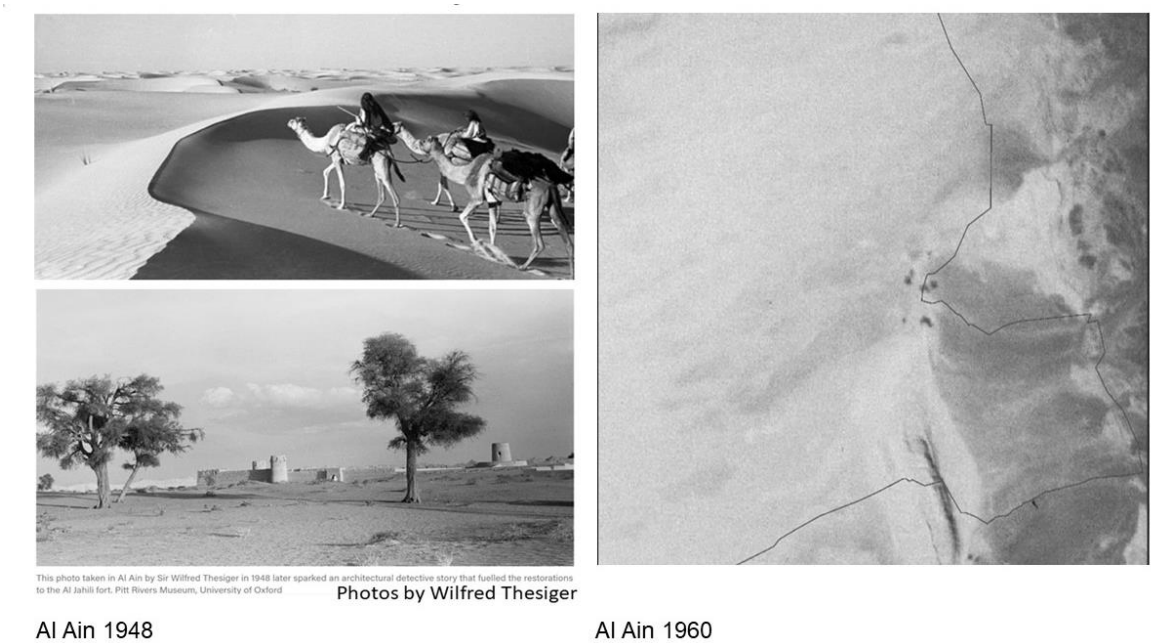

Figure 6: Al Ain in 1948 and 1960.

Alternative futures – design

The third iteration of the geodesign framework “What, Where and When” was the focus of the Al Ain workshop. It implements the theory and methods and carries out the study. Data is gathered and represented in a format useful for study purposes. Process models are implemented to evaluate the existing landscape as a baseline from which to assess impacts of change. Furthermore, a number of Alternative Futures are simulated, and their impacts are assessed. This allows decision makers to better understand the likely future

Seven main IGC global assumptions were selected to be applied to the Al Ain study, which would shape requirements for alternative futures in 2050:

- The climate will be warmer
- Population will continue to grow
- Fresh water scarcity will become more prevalent
- Food production pressures will increase
- The global economy will double, fastest in emerging markets
- Transportation will become more automated
- The built environment will become more network-oriented and “smarter”

To conduct impact analysis of proposed scenarios on SDGs the following study characteristics were required: 10 systems by which the study would be organized, the area of the study, the spatial requirements for each of the 10 systems (which can be defined in advance), the locational evaluation models for each of the 10 systems, and the system impact and cross system impact models that assess the locational appropriateness for the five levels (figure 7).

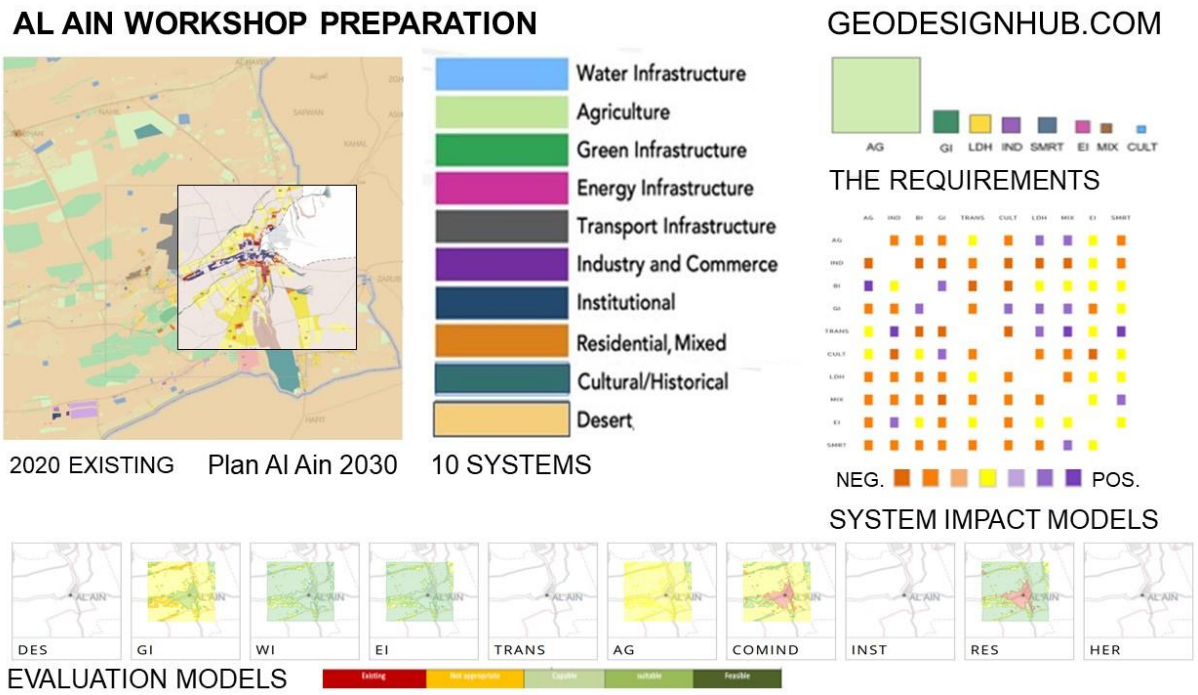

Figure 7: A representation of the geodesign preparation requirements for the Al Ain workshop.

Supporting design of Alternative Futures, the IGC research teams have identified over 150 systems-based innovations that may be expected by 2050 (https://www.igc-geodesign.org/global-systems-research). About 50 of these were preselected as potentially applicable to Al Ain and workshop participants selected which technologies, they considered directly applicable to the future growth of Al Ain.

- Agricultural water conservation
- Ecological pest management
- Solar crop pumps
- Controlled – environment agriculture (CEA)
- Integrated vegetated stormwater infrastructure
- Green urban streets
- Renewable energy sources
- Autonomous vehicles
- Autonomous air taxis
- Computer – integrated manufacturing
- Mixed-use development
- Technology for multi – dimensional use of space
- Protection and management of the cultural – historical heritage
- Protection and management of the desert landscape

Student participants were then divided into six teams, two for each of the IGC scenarios. One team was tasked with making a design that would keep Al Ain as a compact city while expanding its area for new development. The other team was tasked with placing new developments away from the existing urban area of Al Ain, thus keeping the existing city relatively compact. For each IGC scenario, these two teams would negotiate a single design for 2035 and 2050 (figure 8).

Figure 8: The structures of the designs in the Al Ain geodesign workshop.

In the afternoon of the first day of the workshop, the participants made at least two iterations of their designs for 2035 and assessed them for their impact. In the morning of the second day of the workshop, the participants made at least two iterations of their designs for 2050 and assessed them for their impact.

Comparison and negotiation

In the afternoon of the second day of the workshop, the teams were introduced to the tools in Geodesignhub, which support comparisons and negotiations. Each team presented its designs to the other team in its scenario pair, and they conducted a negotiation to derive a single geodesign sequence from 2020 to 2035 to 2050

The early adopter 2035 design assumes a change in the existing Plain Al Ain 2030 so that innovations can be immediately integrated into the planning for 2050. It is based on doubt that the residential densification strategy in Plan Al Ain 2020 can be accomplished. The design therefore extends development along six major existing transportation corridors while decentralizing industry to the airport and two other existing industrial zones. It places major forests for desert management and agricultural development to the west. By 2050, a new compact set of western developments will be proposed, in part to maintain the character of the existing city of Al Ain and separate it from the desert and forest. It maintains a large desert region in the northern portion of the study area (figure 9).

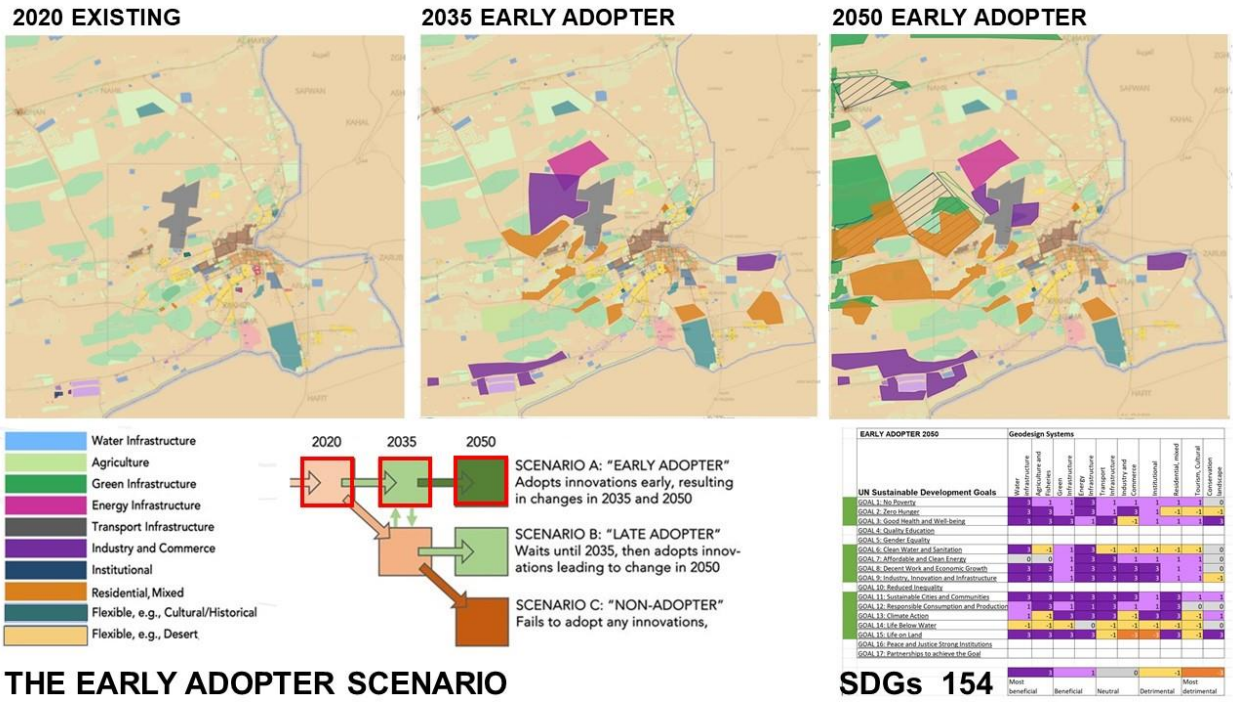

Figure 9: The Early Adopter designs.

The late adopter 2035 design follows the Al Ain Plan 2030, but it also is based on scepticism that its development plan can be accomplished. By 2050, urban development must be undertaken outside the existing city boundaries, where the growth strategy of the early adopter design is developed along with the initial western development. New forests and agricultural development are placed to the west of Al Ain, while industry is concentrated in the current industrial zone to the south west. Substantial desert is maintained in the north (figure 10).

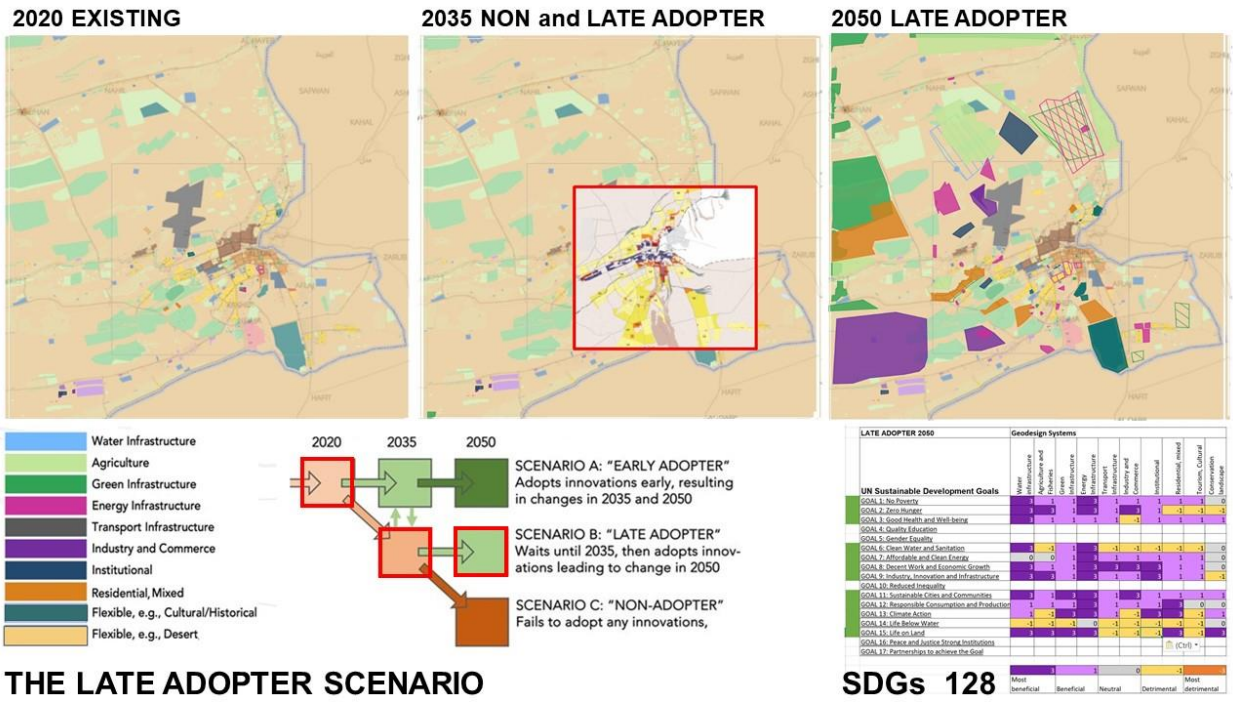

Figure 10: The Late Adopter designs.

The non-adopter 2035 design likewise follows the Al Ain Plan 2030 and is also based on scepticism about whether its development plan can be accomplished. By 2050, urban development must be undertaken outside the existing city boundaries. While seeking to maintain the character of the existing city, the design proposes three new urban centres and an extensive program of controlled environment agriculture and forest development throughout the study area, substantially transforming the desert into a "green" landscape (figure 11).

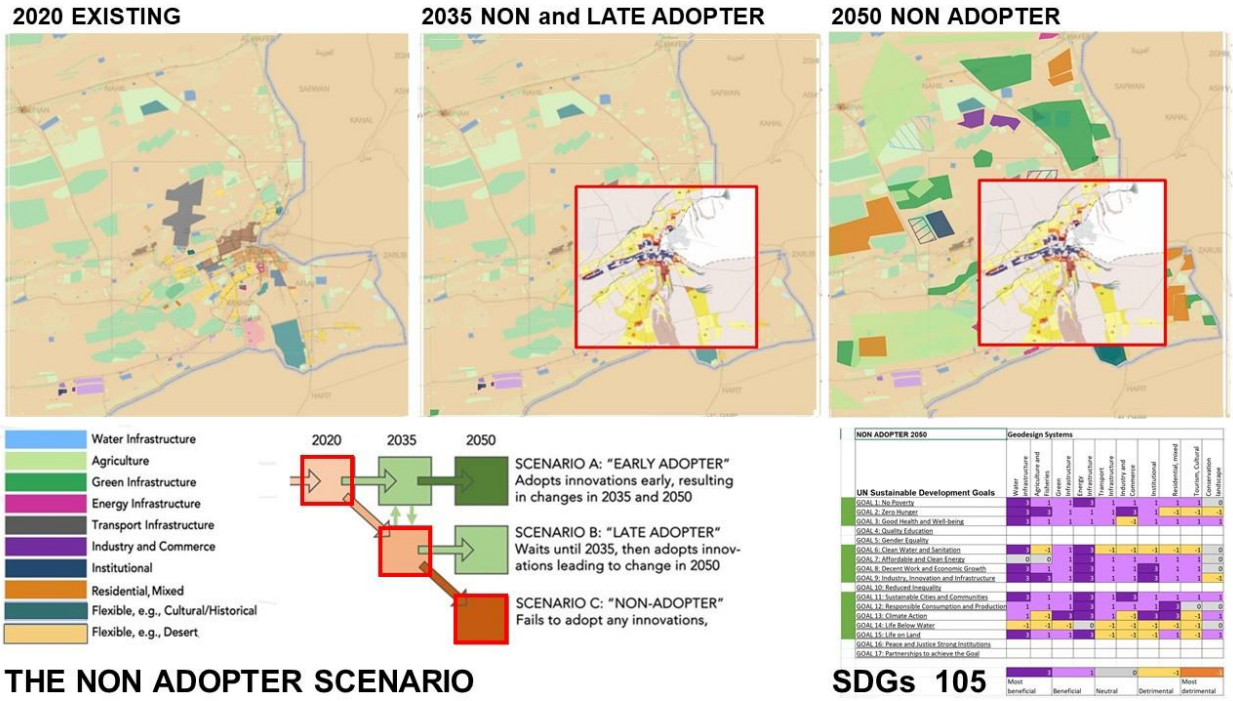

Figure 11: The Non-Adopter designs.

The three 2050 outcomes were comparatively assessed for their UN SDGs compliance after the two-day workshop by experts. The early adopter 2050 design creates the greatest beneficial impact to the sustainable development goals (154) when compared to the late adopter (128) and non-adopter 2050 designs (105). Perhaps equally significant, it clearly maintains the urban development objectives initially proposed by Sheikh Zayed as guiding principles for the development of Abu Dhabi. In the long run, and as indicated in this workshop, the cultural heritage which has been focused for centuries on desert life is at significant risk that “the sense of the desert” itself will disappear (figure 12).

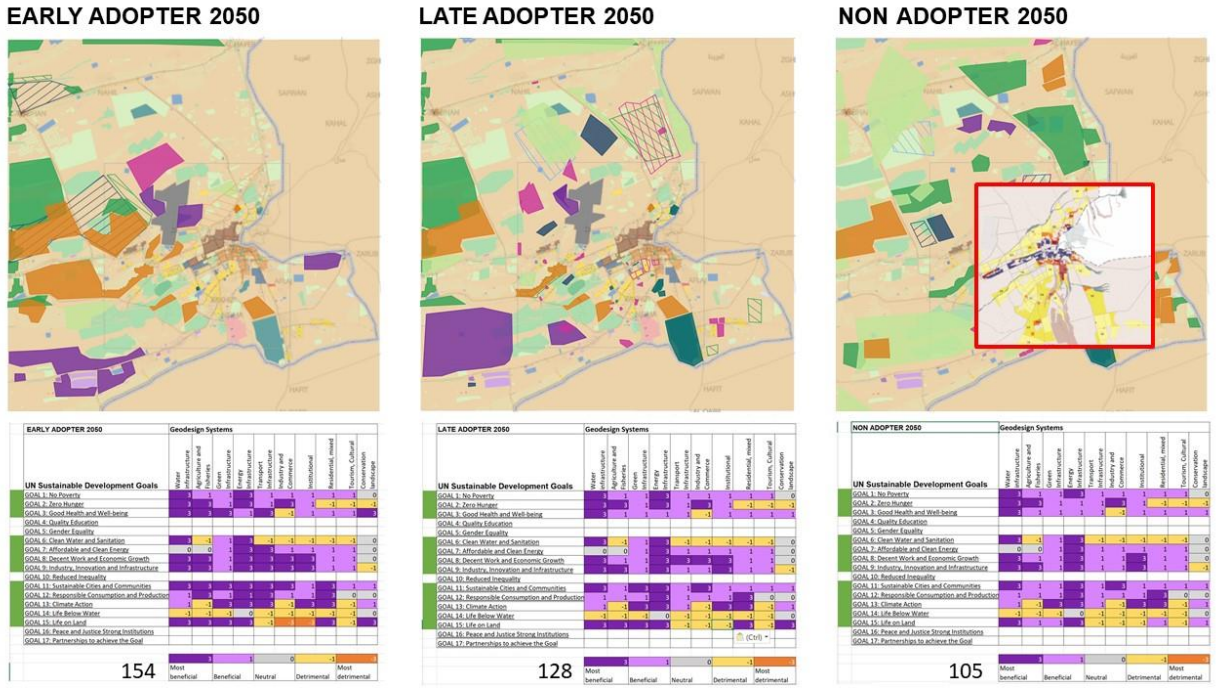

Figure 12: Assessing the 2050 designs by compliance with the UN SDGs.

Conclusion

At the end of the workshop students were asked to reflect on their learning and the methods they applied in their study of possible futures for the city of Al Ain. First, all students agreed on the ease with which they commanded the general concept of the method and the logic of the different stages it consisted of and were immediately comfortable in following its logical semi-structured approach. Further, the method afforded the students with the opportunity to practice and appreciate the relationships between processes and outcomes, and the iterative nature of planning and decision making, in a more practical hands-on approach than they are often exposed to in planning classes. This, by itself, is very significant as it points to the potential of using the method as a valuable educational platform, thus reinforcing the practice and experimentation components in planning education.

By using this method, students noted that concepts such as smart growth and sustainable developments became much clearer, and the need for communication and negotiation among all participants was vital. Furthermore, by using a process of learning through direct engagement, the students got to appreciate planners' roles in the planning and decision-making process, particularly in aspects having to do with interpreting data, developing future scenarios, and negotiating and deciding between alternatives. The workshop also allowed the students to directly engage with and consider pertinent issues in their local planning scene and empowered them to think and creatively apply knowledge from their planning education towards developing and evaluating future scenarios for the city of Al Ain (figure 13). Because of all of these reactions, the students were enthusiastic and wished that the workshop continued longer than the pre-planned two events in order to further reaffirm their learning and command of the method in other planning tasks in their local areas. All of these are strong points that align with the UAE strategic goals of building local capacities that are well equipped to assume key planning roles in the different planning agencies at the government and practice levels.

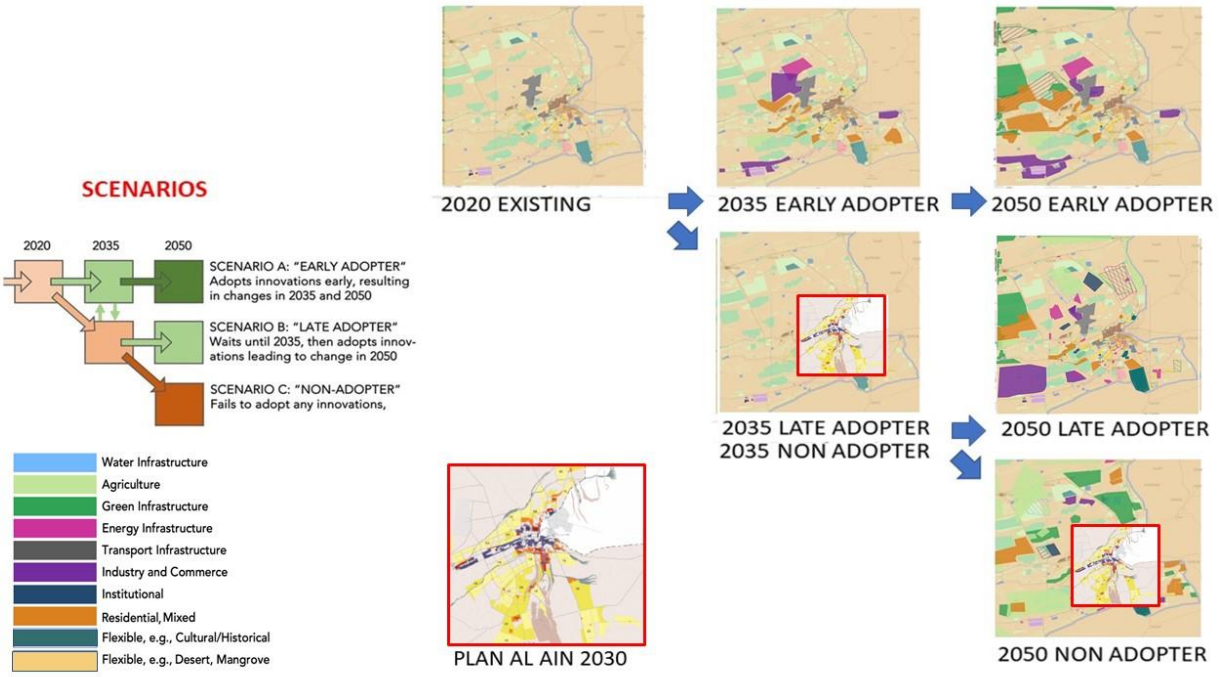

Figure 13: The Al Ain Geodesign workshop

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