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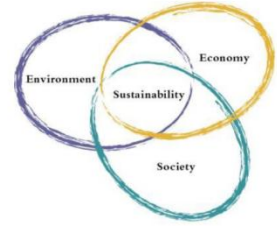
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Participatory Design for Sustainable Community Development

Case Study: A Dates Pack-house in the Egyptian Western Desert

A Thesis Submitted to

The Graduate Program in Sustainable Development

in partial fulfillment of the requirements for

the degree of Master of Science in Sustainable Development

By: Dina Bahaa Eldin Mohamed Hussein

Under the supervision of: Dr. Amr Abdel Kawi

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The American University in Cairo

Spring 2019

Acknowledgements

I would like to endlessly thank my advisor Dr. Amr Abdel Kawy who has always been giving me endless support. Words will never be enough to express how much I appreciate Dr. Amr's presence, encouragement, and guidance in every step along the way. I would also like to thank my examining committee, Dr. Ashraf Botros and Dr. Hisham Gabr, for their help and valuable advice.

I am forever thankful to my parents Bahaa and Amany, my siblings Randa and Mohamed, and my aunt Nahla. Special thanks to Dr. Ibrahim Abotaleb, my beloved husband, who has been always pushing me forward with his moral and technical support.

My special thanks are extended to Dr. Tina and Mohamed Batran, for introducing me to El-Heiz, helping me with data gathering, and for starting the noble project of the dates pack-house. I would also like to thank Sara Harb, Ahmed Tarek, Dona Alaa, Hossam El Zayat, and all my other classmates for working on the project of the dates pack-house, and Muhammed Khaled for always guiding us throughout our master's program.

I am particularly grateful to Eng. Mostafa Hossam, Architect Zeiad Amer, my friend Menna Mansour, and everyone who listened critically to my endless talks about my research and gave me valued feedback.

Huge thanks to the people of El-Heiz, for welcoming me and for giving me this rewarding experience. I am looking forward to the day I get to thank everyone above with dates from El-Heiz dates pack-house.

Finally, the biggest thank you goes to God, who is the reason behind all my success.

Participatory Design for Sustainable Community Development

Case Study: A Dates Pack-house in the Egyptian Western Desert

Abstract

Over recent years, participatory design processes have been gaining momentum in the architecture field. This research analyzes the past experiences of the participatory design processes from literature and case studies to apply it on an ongoing sustainable development initiative for creating a dates pack-house in the Western Desert Oasis of El-Heiz. The aim of the development project of the dates pack-house at El-Heiz is to help achieve a more sustainable community economy. The research is done through understanding past intervention in the area, mapping the whole participatory design process (while being a design participant) in its various stages, and finally analyzing the outcomes. The methodology for mapping the process entails qualitative and quantitative assessments by being a participant observer documenting the whole process through observation, interviews, participatory action research and gathering numerical data. The project applies a triple bottom line ¹ sustainability analysis, and a critical assessment of the practicality of the building design for the operational process. This includes users' feedback, modifications performed on the building, and the community impact. The study specifically answers questions -and raises others- about participatory design approach in architecture, while analyzing the potential of architecture in creating sustainable community economies in Egypt, especially through participatory design processes. This thesis also seeks to offer some recommendations for participatory sustainable design of community based commercial facilities.

¹ Triple Bottom Line: A framework that includes social, environmental and economic aspects or "people, planet, and profit".

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1. Introduction

1.1. Background of the Problem

Agriculture in developing countries usually involves a gap between the producers and the end markets (Trienekens, 2011). This gap is due to farmers having small capitals to invest, lacking resources, and depending on family labor only while being disconnected from the value chain and the market players (De Janvry and Sadoulet 2005; Reardon and Barret 2000). El-Heiz Oasis in the Western desert of Egypt is one of the many examples where farmers sell their products at very low prices compared to their market prices, and are not involved in the value adding activities of their products. People living at El-Heiz have some of the best dates in Egypt, that are sold as end products with expensive prices. However, people living there get a very small share of this price because they sell the dates directly after harvesting, then it goes through a long chain of middlemen. According to the United Nation's Food and Agriculture Organization, Egypt is the biggest dates producer in the world, with dates produced in the Nile Delta, the Nile Valley (specifically Siwa, Baharia, Farafra, Dakla, Kharga and Fayoum oases), Sinai, and Matrouh (Riad, 1996)

Tina Jaskolski, an AUC professor and researcher at AUC Center for Applied Research on the Environment and Sustainability (CARES) and Mohamed Batran, a PhD student in the New School in New York decided to take this opportunity and invest in building a dates pack-house at El-Heiz. A master's class taught by Tina in the sustainable development program was divided into teams to work on this project. Having a dates pack-house at El-Heiz will add value to the local products of the locals, and enable them to sell their own dates as end products. Designing the pack-house is challenging; the locals have their own ways in dates processing that differ from other locations, most importantly, that they oven-dry the dates instead of fumigation. Also, they have their own cultural traditions regarding women employment. They are also used to dividing the tasks in certain ways among the community members, some working outside and some working from home.

Therefore, participatory design approach was adopted as the optimal means for designing the dates pack-house in order to ensure that the pack-house will be built in accordance to the local needs and traditions and will be a sustainable project that withstands time.

Even though participatory design in architecture involves the users from the beginning, the level of success of these projects vary. The level of user participation, the sustainability of the project, and the extent to which the implementation is similar to the design vary. It is important to understand the nature of the participatory design approach and how it can be most successful. This study seeks to apply the knowledge from literature on developing the dates pack-house project at El-Heiz with the aim of learning from it to be able to contribute to a more sustainable community economy. A participatory design community-based facility building is something that can be implemented not only in El-Heiz, but in several similar cases where it can help in building more sustainable communities.

1.2. Research Objectives

Objective: This study seeks to better understand the nature of participatory design and apply it on developing the dates pack-house project at El-Heiz to contribute to a more sustainable community economy.

Broader Impact: A participatory design community-based facility building is something that can be implemented not only in El-Heiz, but in several similar cases where it can help in building more sustainable communities

The focus of this research is to study participatory design approaches in architecture and their integration with environmental sustainability as a means of contributing to the economic sustainability of a community. This is done through mapping and analyzing the process of conceiving, designing and building a dates pack-house project at El-Heiz in the Western Desert of Egypt. This will include:

- Relationship between participatory design architecture and sustainability.

- Analysis of the participatory design process and how & why the design changes during implementation
- Triple Bottom Line analysis of the dates pack-house and of the wider impact on the community
- Recommendation for more sustainable community based facility buildings

1.3. Research Questions

This research attempts to answer the following questions:

Participation:

- What are the factors that lead to changes along the participatory design process - even though it was participatory from the beginning?
- What are the success factors of participatory design projects?
- What are the pitfalls that the community and facilitators fall in during participatory design projects?

Sustainability:

- What can be the guidelines for participatory sustainable design of community based commercial processing facilities?
- What are the internal and external barriers to sustainability of participatory design projects?

El-Heiz Dates Pack-house:

- Are research-based community projects sustainable?
- Will the dates pack-house at El-Heiz contribute to creating a more sustainable community economy?

2. Methodology

The research approach entails studying participatory design approaches in architecture projects in the literature, and use that as a basis for studying the case study of El-Heiz dates pack-house. In this case study, I am a participant observer where I work on the participatory design of the dates pack-house while observing and documenting the whole process. This documentation includes my own reactions as well, in order to be aware of my biases and control them. Being part of the process means that the researcher both affected it and got affected by it. In some situations throughout the process, the researcher might have had non-objective opinions, which were fully exposed and documented in order to be critically aware of them. While the data includes some numbers of the expected increased income from the dates pack-house project, most of the data the researcher gathered is qualitative. The data is gathered through observation in the regular visits, interviews with the locals as well as professionals, focus groups, and workshops with the locals. The documented data is later analyzed so as to identify patterns. Through connecting and analyzing these patterns some themes related to the community and our interventions as outsiders are identified. This experience addresses broader questions about participation and sustainability in the architecture field.

The methodological approach involves a series of steps with the aim to better understand the nature of participatory design projects in architecture. The first step is studying precedents of buildings built through participatory design approaches. This is through literature review of other cases studies, and through interviews with architects who worked on such projects. The aim is to understand potential barriers to the sustainability of such design projects, the measures of success, and the pitfalls professionals fall in when implementing such projects. This knowledge will then be applied to the case study of El-Heiz dates pack-house.

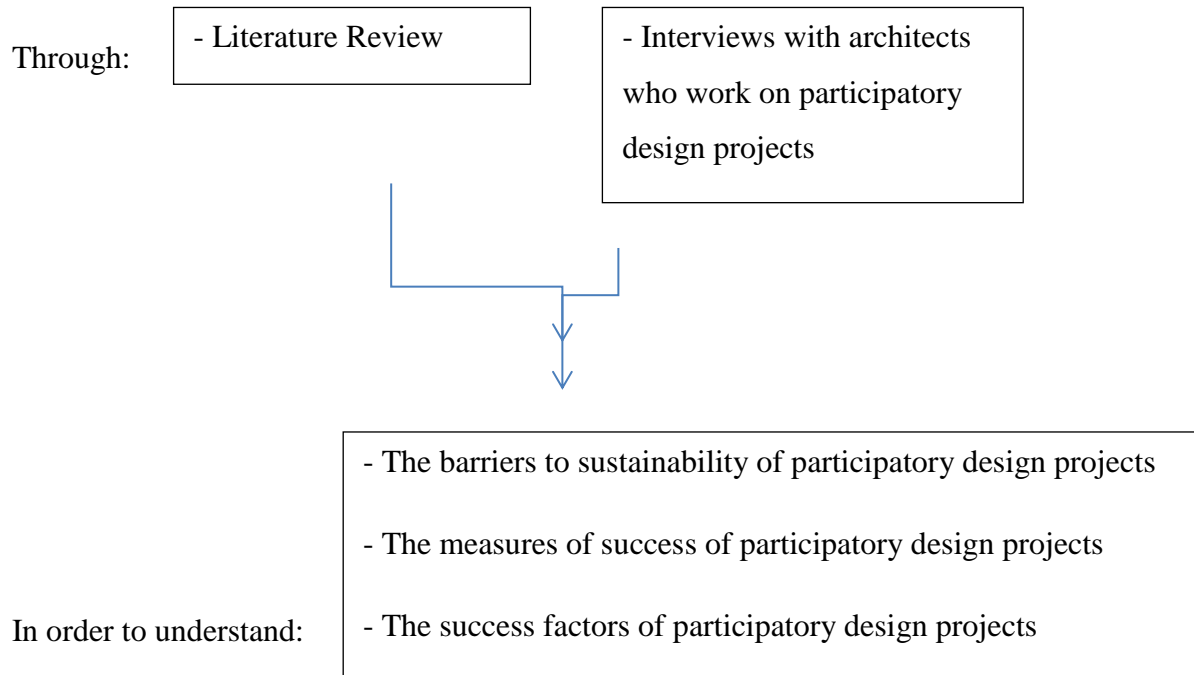
Secondly, before working on the project, historical data about the area was gathered in order to understand its past. This included the background of the area in terms of demographic data and the people to understand their lives, culture, and architecture. It also included gathering data about past interventions in the village, as well as the pilot project that the primary participants conducted for dates production. This data was gathered through interviews with both the locals

and those who intervened in the past. This step was important in order to understand the nature of the place and the community with its historical background.

The third step was mapping the participatory design process. This included documenting the classwork through observation and interviews. Also, this step involved working on the design development of the dates pack-house in an iterative design process through having workshops with the locals at different design stages, and interviews with architects and sustainable design professionals. There were regular visits to El-Heiz to observe the whole process. During the visits, interviews and focus groups were held first with locals including farmers and date producers, people who worked on the pilot project, women, and the land owner. This was to know the opinions of community members of the pack-house, the percentage of participation, who participates, and to what extent. Also, it was important to understand the potential impact on the community, as well as the change in their income from the project, if any.

The methodology can be summarized in the figure that follows:

1- Previous Case Studies of Participatory Design Projects



2- Gathering Historical Data for the Dates Pack-house Case Study

Background of the Area
and People

Past Interventions in the
Village

Pilot Project for Dates
Production

Through:

- Interviews with locals

- Interviews with those who intervened in the past

In order to:

Understand the nature of the place and the community
with its historical background

3- Mapping the Process

	Documenting Classwork on the project	Design Development of the Dates Pack-house	Regular Visits to El-Heiz
Through:	<ul style="list-style-type: none">- Observations- Interviews	<ul style="list-style-type: none">- Interviews & workshops with Architects/ Sustainable Architecture Design Experts- Workshops with the locals.	<ul style="list-style-type: none">- Observation of the whole process- Interviews with Architects/ Sustainable Architecture Design Experts, Farmers & future factory workers, Women who participated in the pilot phase Land owners, People who worked during the pilot phase, and Architects who designed previous buildings in the area
			<p>To know:</p> <ul style="list-style-type: none">- Opinions of community members of the pack-house- Percentage of participation, who participates, and to what extent- Main benefiting people- Community Income before, during the pilot process, and after the pack-

In order to:

- Document the applied participatory design process that will further be analyzed
- Understand-through a hands-on experience- the nature of participatory design projects with their barriers, factors of success and sustainability.
- Factors that lead to changes along the participatory design process
- Understand if the dates pack-house at El-Heiz will contribute to creating a more sustainable community economy.

4- Analysis

The participatory Design Process of the Dates Pack-house

In order to:

- Identify the factors that lead to changes along the participatory design process
- Examine the effect of the dates pack-house in creating a more sustainable community economy
- Come up with recommendations for participatory sustainable design of community based commercial processing facilities

The case study of El-Heiz pack-house was a practical application of designing a sustainable project through a participatory design approach. Data including notes, photos, and design sketches from the workshops were documented. Interviews and focus groups were also transcribed. From the analysis of this data patterns were recognized. The analysis of the participatory process was through a thematization approach (which is a method for identifying, analyzing, and reporting patterns).

3. Literature Review

3.1. Participatory Design Process

Participatory Action Research (PAR) promotes empowerment, equality and social justice for all (Katoppo & Sudradjat, 2015). Participatory design approach combines participatory action research with design thinking. Design thinking brings back design to its essence of being a problem solving method that is both innovative and human centered (Katoppo & Sudradjat, 2015). Design thinking encourages comprehensive and collaborative ways of thinking, and bridges the gap between the theoretical knowledge and design practice. The design thinking process brings rapid and contextually specific innovation through the combined inspiration, ideation, and implementation stages. This process promotes sustainability. Design thinking should not be tied to architectural design, it is actually a method of thinking that can be applied to different fields such as management and business service, interactive design, healthcare system, and institutionalized policy makings (Katoppo & Sudradjat, 2015).

Applying participatory design approach to architecture goes with the current situation of the world now that is moving towards connectivity. We are in the age of the next or fourth industrial revolution, which promotes connection between professions and people, transparency, and technology. Academics has been placing architecture more towards social science fields rather than natural or pure sciences. Worldwide, issues of participation and empowerment in relation to architecture have emerged more contextually than ever. Discussing the design with the users who will be using the building in the future is very important. The input of various people, locals, future users, experts, should be taken into account when designing.



The participation takes place in various stages starting from setting the design intentions and criteria, the process of design itself, and the implementation or construction. Participation in the construction process gives a sense of ownership to the people. Participation enables adapting projects to the local context with the various influences composing its socio-cultural, economic

and political realities (Mubita et al., 2017). There are different methods for participatory design approach such as workshops, interviews for gathering data from users, and interactive kiosks. In participation workshops, dialogue, on-the-spot sketching, games, and modeling are different communication approaches (Kent 1981). The data collected in terms of users' statements or recorded interviews and workshops can be analyzed to understand how they will inform the design using a thematic content analysis approach (Gray and Densten, 1998; Franzosi, 2004). This approach focuses on recording patterns or themes. For instance, if in a design workshop several users turned the conversation to a specific topic at various times, it may indicate that this topic is a priority to them. This way, priorities are identified from the users themselves, rather than the architects. In design conversations, users have different abilities to express their design needs and different levels of technical knowledge, but it is the architect's skills to be able to comprehend the users' statements (Luck & McDonnell, 2006). Two statements from two users can have the same apparent meaning, yet reflect different levels of understanding of the design language (Schon, 1983, p. 78). Also, sometimes "everybody's words are the same; but the imagination may be different" (Gibson, 1988). There are three types of conversations or dialogues which are: professionals with each other, professionals with the participants or people, and the people with each other (Kent, 1981). Projects can be divided by scale, level of user investment, or the phase of participation.

There is a difference between merely participating and powerful participation. Real participation is power; the ability to influence future decisions with your participation. Sherry Arnstein equates participation to power; engagement by its own does not mean impacting decisions. According to Arnstein, in a participatory project, there should be delegated power to the locals, in order to overcome the issue of difference in power between local participants and the intervening authorities (Arnstein, 1996, 216-224). In participatory action research, the levels of power are transformed to collaboration in which everyone's input and opinion is equalized to the others. Collaboration includes data gathering, data analysis, and planning (Mountez, Moore, & Brown, 2008, p. 221). Literature proving the lack of people's participation in development projects started appearing in the 1970s (Perez, 1999). The need to involve the users in the design of their buildings is not new. In 1967, Nicholas Negroponte wrote in his book *Soft Architecture Machines*: " that there is 'a general feeling that architecture, particularly housing, has been inadequate and unresponsive to the needs and desires of its users ... the design of housing is in

the wrong hands, that is, in the hands of an outside “professional” rather than that of the resident". When people participate in the design of a building, they grow a sense of ownership and the process strengthens their sense of community. Having a stronger sense of community increases the people's desire to positively contribute to solving community problems, as well as their desire to spend more time and effort to meeting community needs (Morris, 1996). Also, when the participants observe actions being taken based on what they said, a higher participation level can then be reached (Siu & Xiao, 2017). Before working on a participatory design project, there are some questions the architect has to ask such as who will the participants be, what will be the scope of participation, what is the objective of their participation, in which stage should they participate and how will they be involved (Sanoff, 2008).

"All barriers between builders and users should be abolished, so that building and using become two different parts of the same planning process" (Jones et al., 2013).

3.1.1. Challenges of Participation

Domination

Giving equal opportunities to the users becomes difficult when some are more dominant than others. Chambers (1994) argued that “in a group, one person may dominate and overrule others.” Therefore, it is helpful to have a mix of data gathering techniques including one on one interviews, focus groups, observation, and others.

Unwilling Participation

In some projects, people may participate without actually wanting to. This could be because of someone with higher authority asking them to participate. Also, people can unwillingly participate if there is a return for participation (Mubita et al., 2017).

3.2. Sustainability

The aim of the dates pack-house project is to make it sustainable such that it helps create a community economy at El-Heiz by enabling local farmers to process their dates and sell them as packaged products.

3.2.1. Adopted Approach to Sustainability

In 1994, in the United Nations World Commission on Environment and Development report, sustainable development was defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The sustainability approach to this project entails being environmentally sustainable in terms of the architectural design of the building and the dates production process, being socially sustainable through creating a project that is owned by the people and inclusive of the community, and economically sustainable through an economic model that sustains profit and ownership to the people. Focusing on sustainable architecture was very important since lack of electricity in El Heiz requires natural cooling and daylight. Also, well designed green buildings are important on the social level too, since they increase comfort level and create healthy environments for the users through aspects like improving indoor air quality, natural daylight, and thermal comfort (Al-Hajeri, 2013). Social sustainability is "a life-enhancing condition within communities, and a process within communities that can achieve that condition" (McKenzie, 2004). Social sustainability also aims to ensure justice and equity between people (Cobb, 1998). Economic sustainability is about supporting a defined level of economic production while saving resources and satisfying the needs and wants of individuals, those in the present, and the future (Baumgärtner & Quaas, 2010). While sustainability means balancing between the environmental, social, and economic aspects, their co-existence result in complexities and require challenging trade-offs (Giovannoni & Fabietti, 2013).

3.2.2. Relevance in a Participatory Context

There is a link between participatory design in architecture and sustainability. As Oakley explains, participation helps in breaking the habit of dependency which grows where there is a lot of development work going on. Participation enables people to address their own problems

and implement positive solutions (Oakley, 1991). The users begin to have more control over their own resources; they become more able to plan and implement future developments when they become part of current ones (Oakley, 1991). Paulo Freire also emphasized the point that participation is part of sustainable development through enabling people to analyze their situations and work on them (Freire, 2005). Based on several case studies, it was suggested that projects designed through participation have higher chances of success, because they are "resident-driven", and residents are more aware of their environment than outsiders (Sanoff, 2000).

3.3. Case Studies

The following projects were studied to understand the dimensions of participation in design, as well as in environmental, social, and economic sustainable building designs.

3.3.1. Case Studies in Egypt

New Baris Village by Hassan Fathy

The New Baris project was studied as a case for an environmentally sustainable building in a similar desert condition as the dates pack-house. In this project, Hassan Fathy had no community to design for. The location was a place in the middle of nowhere where they discovered a water well 60 km south of the Kharga Oasis back in 1963. It was estimated that this well had the capacity to irrigate up to 1000 acres of land. Therefore, the organization for desert development proposed creating an agricultural community in the area. The intention was to attract 250 families, half of them farmers and the other half from other service sectors to settle there and create an agriculture community.

Hassan Fathy was commissioned to design a market complex, two large houses, one small house, a bus terminal waiting room, unfinished administrative center, and further away a car workshop. Since the temperature there reached fifty degrees Celsius and the fruits and vegetables needed to be stored in a cool place before transporting them, Hassan Fathy built an underground space, and implemented passive design methods for natural ventilation.



Figure 1: New Baris by Hassan Fathy

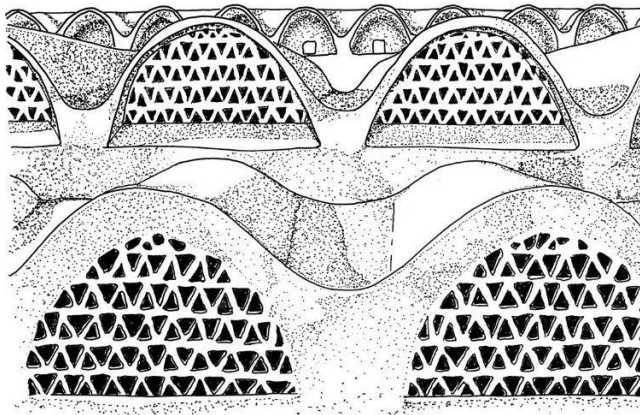


Figure 2: Sketch for the New Baris by Hassan Fathy

As shown in the sketch, the form of the mud brick building had Nubian vaults at different heights, with openings, so that they capture the wind into the building. Hassan Fathy was able to reduce the temperature through these techniques by fifteen degrees Celsius in the underground room to be used for temporary storage.

Twenty seven families coming from Ismaliya lived there for only one year. New Baris was never more occupied, and it was completely abandoned in 1967 after the Israeli invasion of Sinai.

This project inspired the design of the dates pack-house, especially the idea of having vaults at different heights with openings for passive ventilation. Being in a similar context, it was essential to address the problem of high temperature.

Balat- Vernacular Architecture

This project, that aimed for preserving vernacular architecture in the Dakhla Oasis, implemented participatory design approach to design a sustainable functional house prototype that can be replicated by the locals.



Figure 3: Balat Town in Dakhla Oasis

Balat is a small town in the eastern entrance of Dakhla Oasis in Egypt's Western Desert. Balat town is 22 km from Mut, the capital of Dakhla Oasis. This project, which was initiated by an Egyptian professor and researcher in Lund University in Sweden, seeks to preserve vernacular architecture in Egypt, and Balat was a case study. The aim of working on this case study was to preserve the historical houses there. Workshops and interviews were held with the locals to understand why people were leaving their old houses. The locals listed the problems they face in their old vernacular houses which included: structural cracks and roof openings that let rain water as well as insects in, they needed larger space in their houses, and they wanted “new” buildings.



Figure 4: Workshop at Balat Town

The team working on the project held several seminars and workshops with the locals to design a model house that keeps the traditional sustainable architecture of the area while giving them the advantages of the concrete houses they had started adopting. In the workshops, the locals sometimes drew boxes indicating how they want rooms in the house with their fingers on the sand. The final stage of the project was building the house. This involved local workers and a local carpenter, who were all paid. The location of the house was decided by the local municipality, a local NGO, and local representatives. “The model house was seen as a means of incorporating inherited intangible values in ways that respond to contemporary needs.”

Interviews with the locals after the construction of the house showed that they are willing to get back to building in a sustainable way, if the buildings were to solve their problems with the old houses like the model they designed.

This case study was informative on ways of user participation in a similar context to El Heiz, as well as understanding how to perceive the locals needs and translate them in a building.

Redesigning Tablita Market in Historic Cairo

This project, carried out by Agha Khan Cultural Services and the Center for Development Services in Egypt, is an example for implementing participatory design in an Egyptian context.

The Tablita is a large market dating back to in Al-Darb Al-Ahmar in Cairo. 972 A.D. Despite of the rich architectural value of the area, there are many uninhabited places due to the physical deterioration of the buildings in some locations and the governmental ban of building in others. This project of redesigning the market aimed at improving the economic and environmental conditions of Al-Darb Al-Ahmar. This redesign process was done through community participation. The methods of participation included semi-structured interviews and workshops with the vendors in which they experimented with a physical model. The power structure of the market system was very complex as some vendors are more powerful than others. To ensure equal levels of participation, there were various groups for the workshop sessions representing different vendors along the power hierarchy. The physical model used in the workshops was very useful since it had loose parts that the participants moved around to see the impact of every design decision on their market. Given the large scale of the project and the educational level of the participants, the physical model helped in clear communication between the designers and

the vendors. Before the workshops, the reaction of some of the male vendors was that female vendors should not participate in the decision making. Also, an initial reaction to many vendors was that their participation is useless. According to them, this was because they did not trust that their words would be taken into account, and they do not think that they will know better than the architects and professors working on the project. Throughout the workshops, their opinions changed, and they began witnessing their impact on the design, that they even had intense arguments with one another due to each vendor wanting favorable conditions for his/her location.



Figure 5: Modeling Workshop with the Locals

One of the main lessons learned from this case study is understanding the concept of power relations in an Egyptian context, and to ensure that less powerful groups are given equal opportunities for participation, through holding separate workshops for different power groups to avoid the problem of dominance.

3.3.2. Case Studies in the World

Farmworker Housing Project

The Farmworker Housing was a project for improving the housing conditions of farm workers in North Carolina. Many of these farmers were migrants, and their housing conditions were overcrowded and in very bad conditions. This led to Professor Henry Sanoff in the N.C. State University School of Design to design a special group for doing a workers housing project. The

results of the project were design guidelines and floor plans, and the guidelines were published in the 1998 document Introduction to Migrant Housing Inspections in North Carolina.

The project involved Professor Henry and 15 students working with participating farm workers to design their ideal community housing. Methods for participation were field visits for observation of the current housing and its issues, followed by design workshops. These workshops were to validate the findings of the field visits, and to prioritize the problems found. The workshops were attended by the team working on the project, farmers from different locations, as well as a translator to enable the farmers to express their problems in their own language. The team provided the workers with wooden blocks and they started playing a game to model their own farmworker housing community. They played the game in groups. When there were disagreements, they had to discuss them till they reach a consensus in order to finish the game. From the different groups, some patterns were identified such as: using trees for separation, separating family housing from single men's housing, and arranging the units so that they create small social spaces in between. The result of the game was design criteria, which included guidelines the workers set for orientation, zoning, circulation, privacy and ventilation. Given the budget of the project, the concept of trade-offs was very important to apply. This was done through a game in which the workers had points to buy with, the total number of points was not enough to be the highest quality of everything they wanted, so they had to give up on some aspects or replace them. Through including the workers sharing the budget with them, they decided on what they were willing to compromise. Throughout the participatory design process, all decisions were taken through similar games, which helped the participants both understand their options better and reach consensus easier.

In this project, to make sure the local farmers and professionals were on the same ground, a mix of methods were used: physical models, games, and conversations. To ensure reaching common ground was very important specially when the professionals and the participants have different educational and social levels.

Private Sezin School Open Roof Space / ATÖLYE

This project showed ways of involving the future users in the design process. It is an example of early user participation in the design process. Along with adopting a participatory approach, the project was designed to be environmentally sustainable.

The private Sezin School in Istanbul wanted to create a new space to enable problem based learning and knowledge of the latest skills. ATÖLYE designed it as a pedagogical laboratory, integrating different facilities in a hybrid space on the rooftop. The function of the space was for meeting, working and learning. The project focused on stakeholder engagement. Firstly, prior to design, there were passive observation sessions by the architects. This enabled them to witness and understand the lifestyle of the students, their routines and use of spaces in school. The design of the project started with a design thinking workshop that encouraged collaboration. Also, there were regular site visits, interviews, and workshops for design crits. Other than students, the workshops involved the Education Reform Initiative which is a leading institution that aims to promote and enhance education in Istanbul. This aimed to trigger collaborations between institutions to enable the replication of the project in other schools, which was a sustainability dimension considered from the beginning of the project.

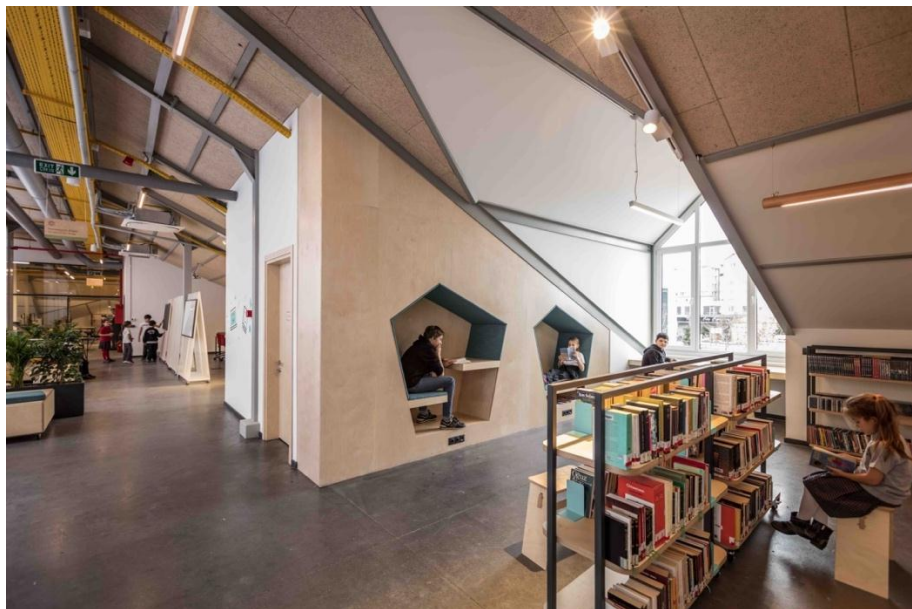


Figure 6: Private Sezin School Open Roof Space

This project focused on giving the school community a sense of ownership. The lighting system in the event space was designed, a prototype was made, and the actual lighting was manufactured, all in collaboration with a group of students and teachers. This ownership through participatory design not only gave the participants a sense of ownership, but also taught them something new. Mutual learning is one of the characteristics of participatory design, where knowledge is continuously shared between the designers and the users (Dayle & Schively Slotterback, 2009).



Figure 7: Lighting Fixtures



Figure 8: Private Sezin School Seating Areas

Methods of participatory design implemented in this project were applied in the dates pack-house project, specifically observation, interviews and workshops. Also, the idea of users' involvement not only in the design phase, but in the construction, phase was applied as well.

Playground Prototype / Aescala

This project was a children's ethnographic exploration that was used as a design guide for a public space in 2017. This project explored ways of participatory design in architecture that involved the users in the design decisions. The team working with the users were not only architects, but the team was formed of two architects and two social scientists; the idea of a multi-disciplinary design team is similar to the case of El-Heiz dates pack-house.

The location of the public space was in Santiago, Chile. The research phase of the project involved a six months ethnography with the aim of understanding the way children use the space both individually and collectively, and in different situations. The observed group was made up from kindergarten kids from two public schools in La Cisterna and Recoleta commune in Santiago. In this case, the children were not already using the space before the project, but they were brought in for the research, which could be different from how frequently it will actually be used.



Figure 9: Playground's Site Location

The dispersion of games in poor condition was designed in a wood square in the center that surrounds a sand pit. The form integrated the wooden play areas with benches to allow for involving teachers in the play time. Wooden panels were chosen since it was the most affordable material.



Figure 10: Playground Birds Eye View



Figure 11: Photos at the Playground

The idea of designing around the way the user moves in a space is what was implemented in the design of the dates pack-house where the design followed the steps for dates production.

School Dormitory for 100 Students / ASA Studio

This project also involves the users in the process on different levels, from design till construction. It focused on the three pillars of sustainability, while using a participatory approach to design Rwamagana Lutheran School dorms in 2016.



Figure 12: School Dorms Under Construction

This project aimed to achieve sustainability, functionality, and cost effectiveness while socially empowering students through participatory architecture. Students were involved in the design phase of the project. During construction, there were on site step by step trainings, mock-ups, and material tests. In this project, the workers learned ways to enhance their traditional construction techniques and to use alternative local materials which are more sustainable. They were not transported for long distances to reduce greenhouse gases emissions and also cut costs. Using local materials also helped in involving the community at the level of production and gave them opportunities to increase production. For instance, there were artisans close to the site who produced the fired bricks. Also, the natural stones used for the building's foundation were

quarried at a nearby village and brought to the site. The construction process was performed through low-tech tools that the users were able to use.

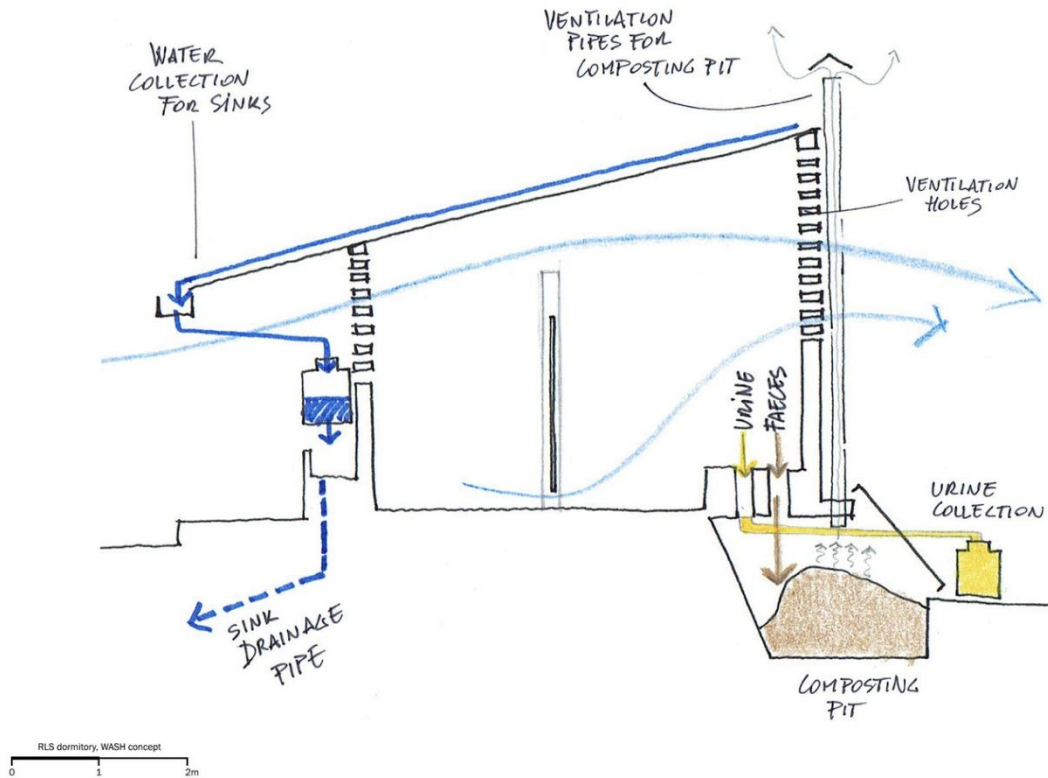


Figure 13: Environmental Design Considerations Sketch

This case study was informative on several dimensions: participatory design methods and environmental design that does not only focus on passive design methods for cooling and ventilation, but also for water collection and waste treatment. This was very relevant for the case of the pack-house because with more dates being processed, more waste water and materials from processing will be produced. These were considered in the dates pack-house project as will be further discussed.

3.3.3. Summary

From the above-mentioned case studies, it was decided to create a participatory design process starting with pre-design workshops with the locals, followed by design workshops and focus groups. In the workshops, participatory design methods were mainly sketching along with using

digital models for visualization. Also, there was one on one interviews to enable participants to express their personal opinions. Learning from the problems architects usually face in workshops, workshops were divided so that participants have equal power levels (from Al Tablita market case study). The questions of the interviews were tailored to understand the locals experience with dates production as well as their vision for the dates pack-house. Learning from case studies with similar desert conditions, passive design techniques were suggested and discussed to select the most suitable design for the project (from New Baris and Balat case studies). Along the process, more topics were discussed with the locals, in both the group workshops and individuals' interviews.

4. Project Background: Dates Pack-house at El-Heiz, Western Desert

4.1. El-Heiz

El-Heiz is located at the south of Bahariya Oasis in Egypt. It lies 40km from Bawiti, which is the main town in Bahariya, and 400 km southwest of Cairo. The village has around 3800 residents in around 600 households, who only started moving to El-Heiz 130 years ago. Their homes are dispersed across seventeen hamlets within a 14 km radius. Archeological remains in the area date back to hunter gatherer times. Also, El-Heiz has a historic monastery called Qasr Msuda from Roman times.

Residents have long histories in the place and a culture known for its strong social capital. They are organized around extended families that mostly work on farming in their divided lands. Their small pieces of lands are scattered around different hamlets connected to the natural water sources. Families usually help each other with labor and agriculture tasks, and often share their products during the harvesting season. Women at El-Heiz rarely leave the houses, but they contribute to saving expenses through homemade supplies (such as bread). People at El-Heiz live a very primitive lifestyle with only electricity in a few areas in certain times of the day. They work in agriculture, and mainly dates production, yet there is some watermelons production in the spring season too. They produce around 500 tons of palm dates annually from almost 10,000 palm trees, which is 3% to 4% of the annual oasis' production. Lack of electricity makes people at El-Heiz unable to store food in fridges, therefore they usually have to travel 40 km to Bahariya Oasis to stock up on supplies. This triggered "Tanweer El Heiz" project by Maddad, a crowd-funding online platform that raises money for the less famous NGOs and causes. Tanweer El Heiz project aims at raising enough money to supply all homes with solar panels for power supply, but most homes still have no electricity.

Regarding water, wells from the Nubian Sandstone Aquifer-at depths of around 350 meters-are used for both irrigation and drinking. The government operates the drinking water well and most irrigation wells. There are some other private wells drilled by the farmers.



Figure 14: Map of Egypt

4.2. Local Architecture

People of El-Heiz live in extended families. Relatives usually own a big piece of land. They build houses arranged in the shape of a rectangle with a large shared courtyard in the middle. Sometimes, they leave part of the land unbuilt, and when a family member is getting married and they need an extra house, they build it. Women spend their day inside their houses or together in the shared courtyard, baking bread together, or doing housework. Kids of all the family play together in the courtyard too. One cannot get in the courtyard without passing through one of the houses, which makes the courts private to the family members only. When I first got into one of the houses, I had no clue what the inside will be like. But through the corridor crossing another door, I found myself in a huge unshaded court with grandmothers, mothers, and kids running all around.

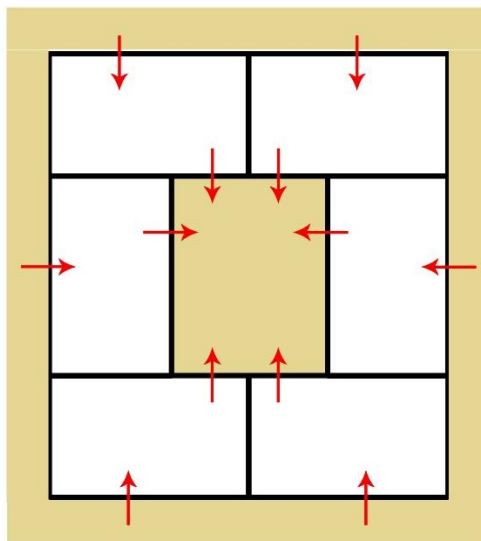


Figure 15: Illustration for the Arrangement of Houses Around the Private Courtyard

The houses have high ceilings of around 4.5 meters high. In the past, residents used to build their homes using locally made mud bricks or salty blocks collected from a drainage lake that dries into a salt plain in summer. There are still some remains of mudbrick houses, however nowadays, people usually import white limestone bricks produced in the Nile Valley city of Minya, and use them for building their homes. Some also started building domes and vaults, but when they do, they bring builders from outside the village because local builders do not build domes and vaults.

All buildings are one or two story high. Sometimes, they build one floor and add a room on top if they cannot build a new house on the land. There is one orange multi-storey residential building in the village. This is a governmental building that was built by the government for some families and each family was given one apartment. None of the families moved there. Living in a typical apartment building with small flats is not how they prefer to live. Currently, there is only one family staying temporarily there because they are renewing their house and adding a room to it. Because the building is deserted, and the apartments are not even locked, this family -of parents, a boy, and a girl- is taking an extra apartment on the same floor.

This case has been repeated in several places around Egypt, where houses were built for people, yet they refused to move there. It is the disconnection between the users and the government or the architects that creates this gap between people's needs for their houses, and what actually gets implemented. Even when this disconnection is not there, when those intervening (government/ architects/..) know what the locals want, they do not do it. When someone intervenes in a community, they tend to feel it is their duty to make it a better place, and that they have the knowledge to do so. They think they are intervening in a community to solve its problems, the problems that the locals have had for a long time, and could not solve themselves, because they 'do not know how'. Even if this is true, if people do not know how to get to what they want, at least they do know what they want. We cannot just enter a community and decide to change its people, because they will not. That is why participatory design approach in architecture can be a useful approach to solve this issue. Bridging what people want and the know-how of how to do it.

4.3. Dates Production

According to the United Nation's Food and Agriculture Organization², Egypt is the top country in dates production, followed by Iran and Saudi Arabia. Egypt's annual dates production is

² Egypt. (n.d.). Retrieved from <http://www.fao.org/countryprofiles/index/en/?iso3=egy>

around 1.5 million tons which is 17.7% of world production. At El-Heiz, around 500 tons of dates are produced annually, from almost ten thousand palm trees.

At El-Heiz, dates are harvested then following several rounds of sorting the dates are sold to traders. While sorting, squeezed dates are removed as well as rotten ones. Sorted dates are sold in bulk to traders. According to the market study and the pilot project of the dates pack-house, the investors forecast that through packing dates locally the farmers, instead of the current 12,000 Egyptian pounds they make per ton when selling in bulk to traders, farmers will be able to make around 21,000 Egyptian pounds per ton for plain unpitted dates, 33,000 Egyptian pounds per ton for plain pitted dates, 52,000 Egyptian pounds per ton for peanuts stuffed dates, and 50,000 Egyptian pounds per ton for almond stuffed dates.

The process of dates' production involves harvesting, transportation to the dates pack-house, and processes in the pack-house. The chain happening in the pack-house generally starts with fumigation, followed by washing, storage, refrigeration, hydration, dehydration, and curing. For producing organic dates, fumigation is avoided and can be replaced by drying and keeping the dates in fridges. Drying is done using an oven or a dryer. Alternatively, fumigation can be replaced by gamma ray radiation of dates. As for storage, the optimum temperature is from 0 to 4 degrees Celsius in which dates can be stored for 6 to 12 months. In Egypt, dates are usually fumigated.

There is a pack-house (that locals call "the factory") around 50 km north of El-Heiz which is usually rented out to individual traders buying dates from a wide range of villages around the region. In this factory, there is phosphine fumigation, but the workers sometimes do not follow the standards of 4 or more days of fumigation, and they increase the phosphine in order to leave the dates for 3 days only. According to the FAO, reducing exposure time by increasing the dosage is less effective as this has a narcotic effect on insects (Graver, 2004). The phosphine tablets dosage (based on the tonnage) is usually bought from a near town called Bawiti.

4.4. Intervention History

CARES, or The Research Institute for a Sustainable Environment (RISE) as previously named in the American University in Cairo started working in the Western Desert in Egypt, specifically in

Abo-Minqar Oasis in 2006. Research mainly focused on water management and agriculture. Following this, the institute started receiving grants to implement their research projects. While working on a project funded by the Canada Fund for Local Initiatives, the team at CARES met Omar Hosny, co-founder of Karm Solar who was working on a solar panels project at El-Heiz, funded by the same donor. From that point, CARES started its intervention programs at El-Heiz in 2014. Projects aim at both community development of the area as well as research projects for students and researchers.

In 2014, funded by HSBC, CARES in partnership with the German company AUTARCON installed two pilot solar powered water stations in the remote oases of El-Heiz and Abu Minqar, located in Egypt's Western Desert. CARES also built the Water Educational Center at El-Heiz that educates farmers about water conservation and is a stop-by museum for tourists. The design of the center was a competition won by Architect Sherif Ramzy and his partners, and the design development and site supervision was by Architect Zeyad Amer.

4.5. Pilot Project

Mohamed Batran, an AUC alum and a PhD candidate in the New School in New York has been interested in adding value to local products specifically through eliminating middlemen in agriculture processes and connecting the local producers with the market. Knowing that CARES was working on several projects at El-Heiz from water stations, building the water educational center, canals, to solar panels, Batran thought he can invest in a pilot project for his PhD research at El-Heiz that aims at raising the income of dates production for the locals through cutting off traders, helping the farmers create the end product, and connecting them to the market in Cairo. Batran's first visit to El-Heiz was in July 2017, this was when he started learning the trading processes of dates. Generally, locals sell their dates after the harvesting season, and rely on this income for the following 8 months. During this first visit, Batran decided to alter the value chain of the dates produced at El-Heiz, and have the farmers who produce the dates add value to their harvests rather than directly selling them to traders. The pilot project started with Batran himself and Dr. Tina Jaskolski, a professor in the American University in Cairo and a researcher in AUC Center for Applied Research on the Environment and Sustainability (CARES), who decided to invest in this project. By this time neither Batran nor Tina had any experience with what the

dates go through in order to reach the end consumers; they just knew that while adding a small value to the dates, there will be a huge difference in its pricing. At first, the decision was to start with 15-20 tons of dates, but with their limited experience in the dates field they decided to start with only 50 Kilos as an experiment to get a sense of how much time each step takes, along with the technicalities of the process, and then proceed to a larger pilot between 500 kilos to a ton in size.

Since there was still time for the harvesting season, this time was used to create a brand for El-Heiz dates, and analyze the market. Creating the brand involved working on the logo, packaging, labeling, selling channels and figuring out the options for stuffing that can add taste to the dates. Branding and packaging was participatory, sketching the logo with the locals, and choosing the packaging together. This was not inclusive of all locals, mainly because women rarely leave their houses. Women did not attend the branding and logo design workshop, but their opinion was only taken after the logo and packages were designed.

The next step was market analysis in order to know the different brands, pricing, packaging, and qualities of the dates being sold in supermarkets. When analyzing the market, Batran and Tina observed that most dates in supermarkets were mass produced, and lacked the freshness, level of chewiness, and texture of moist dates, yet they were consistent in terms of quality and with great packaging. There were several gatherings with the locals in order to try stuffing the dates with different types of stuffing and discuss the best combinations in terms of taste. The agreed upon favorites were plain dates, dates stuffed with salted almonds, salted peanuts, and salted peanuts with chocolate.

Five weeks later, it was the harvesting season; Batran bought the dates from the farmers, bought stuffing (almonds, peanuts, ..) to commence the experiment of packaging dates. The process of dates production at El-Heiz started with harvesting, sorting, washing, drying, pitting and stuffing, packaging, labeling, and finally storing in cold temperature. Unlike most dates, El-Heiz dates were not fumigated. Batran created a production process at El-Heiz employing around 15 young men paying them on a daily basis, while women were also paid to wash the dates and heat them in the ovens in their homes. Women contributed to 80% of the post harvest work of the dates in the pilot project. In fact, if it was not for local women, the pilot project would have failed since worms were going to grow in the dates as they were not fumigated, and women saved them

through the ancient technique of oven-drying the dates. After finishing the production process, Batran then sold the dates in Cairo in a place called Mahali in Maadi. He split the profit between the investors (Tina & himself), the farmers, and the workers, 50%, 40%, and 10% respectively. His business model was built around creating a community economy where people make profit from their local products. The pilot project proved that the dates can be sold, but it did not make much profit because he could not sell the dates in Cairo except in that one supermarket since they were not produced by a registered company, which made other supermarkets fear health and legal issues.

According to CARES and Batran, the feedback from the locals about the pilot project was very positive, that they became enthusiastic to work on the big scale project of the dates pack-house building. Upon the decision to start a big scale project, Dr. Tina introduced the project to the 'Implementing Green Technologies in Local Communities' class which I was registered for in Spring 2018, and this was when I became part of the project.

5. Project Stages of Development

5.1. Classwork

It all started when Tina explained the project to the "Implementing Green Technologies in Local Communities" master's class which I was taking in Spring 2018. We were divided into teams to work on the big scale project after the pilot was over. The teams were the financial team dealing with all the cash flows, the technical team for all the equipment needs, electricity supply options, and all technical details, and the architecture design team which included Sara Harb and myself. Since then I decided to take it further, and not let my role end with the end of the course, but to go on completing the design of the building, documenting the whole process of participatory design, and analyzing it.

After knowing all the details of the project from Tina, class teams began brainstorming about the project in class. The dates pack-house was to be located on the land adjacent to the water educational center; this land was more than the area needed for the pack-house. The land was owned by the Freija family, represented by Faragallah Gedoura, known by Freija. Freija and one of his relatives were invited to attend a class with us. In this class, they explained the different processes the dates go through for production, which definitely guided the building design. We had preliminary ideas which we discussed with them. For example, we asked them if having an underground cool room will help in storing the dates away from the heat. While this is theoretically a good idea, they mentioned that they had previous issues with the military before, because they refuse building underground in this part of the desert for security reasons.

While thinking of the design, Sara and I had different alternatives for the layout and the location of the building on site. Freija explained to us that this land is a family inheritance shared by several men and women in their family. In case a family member needs part of the land anytime, they should find it available. Therefore, we should choose a location on one of the edges of the land, to allow for efficient land utilization by other members of the family when they need it. This early discussion helped create design constraints that would have never been the same without the input of the local representative, who gave us some insights before we start the workshops at El-Heiz. Added to this, we had a discussion about the process of dates production.

The Freijas explained that the process starts with harvesting the dates, sorting them out, washing the dates, drying them in the oven, pitting, stuffing, packing and labeling. This was the main process that we built the design on.

5.2. Interviews

Interview with Architect Zeyad Amer

While working on the design development, it was essential to meet the architect who design-developed and implemented El-Heiz water educational center because he must have gone through all the research regarding the local materials, site challenges, building methods, etc. I visited Architect Zeyad Amer in his office, and had an open-ended interview with him in which he gave me a lot of his experience. Arch. Zeyad said that he works a lot in community development projects outside Cairo, with the last project in Aswan. Arch. Zeyad heard from me about the project, and he made me question everything I was saying. Everything I was stating as part of the plan for the dates pack-house was questionable. He explained to me that the proposed budget for the project was not realistic; and that the time schedule too was impossible, from his experience with the water educational center. Arch. Zeyad mentioned that building with natural rocks, which is available in the desert and the most sustainable one for this case, takes workers so much time. He also mentioned that a big challenge that we will face for the dates pack-house is the white ants. Wanting to stick to health regulations for the pack house means we keep insects away, and according to Arch. Zeyad, in this desert location, white ants always find their way. He mentioned a technique he used which is polishing a type of liquid glue around the building and dampening the soil around regularly. He said this was the only way to keep white ants from getting into the building; this was definitely new information for me and the team. I also asked him if he has a recommendation for a way to keep mice away, he mentioned they never succeeded in doing this in the water educational center. Whether through doors, windows, palm leaves on the roof, cracks between the rocks in the walls, mice always got in. Arch. Zeyad said he does not have a recommendation, but we have to find a creative solution for it and think outside the box, even if it was to "bring cats to scare away the mice".

Arch. Zeyad talked to me about the construction process of the water educational center; he mentioned that there were usually conflicts between him wanting to do things right, and letting the workers do it his way, and Dr. Tina wanting the locals to do things the way they see right. I asked him of what he thinks the best material would be, he said natural rock for the walls since it has good insulation. As for the foundation, he advised to use dry stone being the most sustainable and locally available option. I came out of this interview knowing that the coming process will not be as easy as it seemed before.

Meeting Architect Sherif Ramzy

Dr. Tina asked me to invite Arch. Sherif Ramzy to our class. Arch. Sherif Ramzy previously formed a group with his friends and entered the competition that was held at AUC to design the water educational center at El-Heiz, and his team won the competition. This was followed by workshops with Arch. Zeyad Amer who was appointed by the university for the design development and construction supervision. Arch. Sherif Ramzy gave us a presentation about the design of the water educational center, explaining how there were some changes because of budget issues. Their design maximized capturing wind through the form and orientation. The design was also respecting the history of the land which had a pit and some topography dating back to the old irrigation system of the watermelon fields; this pit was left as it is, even though it is not currently used but as a part of the identity of the place, and a bridge was built on top of it which makes the experience of crossing over even more interesting. Sherif mentioned that during construction, things went over budget, so some details in the design were eliminated. Also, the workers did not have the know-how for a large span area that was designed and had to add columns. The construction process also took around 10 months longer than what was estimated. We concluded that the design had to be discussed with the locals early on in the process in order to ensure that what we come up with in the workshops with the locals can actually be implemented by local workers.

Workshops with Architect Ahmed Rashwan

Architect Ahmed Rashwan used to work in AUC on developing the signage on campus. He was invited by Tina, who worked with him before, to class to give us a fresh input on the design and share his experience in desert architecture. Through these workshops, we thought of ways for maximizing natural ventilation such as location of openings, and building materials. We also discussed broad ideas to be shared with the locals; in later workshops, we worked on developing the plans based on their feedback. This included relocation of some connecting doors between spaces as well as relocation of windows after discussing the location of the expected future expansion with the locals.

5.3. Pre-design Workshops with the locals

During the visits to El-Heiz, I had several interviews with date providers, land owners, and the workers who worked on the pilot project. The interviews were open ended, I let them tell me about their village, about their traditions with dates selling, their experience with the pilot project, their opinion of the dates pack-house project, and what they see as priorities for the project to be successful.

People of El-Heiz live mainly by the income from selling their dates. They also sell watermelon, but not as much. They think the dates pack-house will be a strong addition to their village, because it will raise their income and it will employ youth, who -according to information from the focus group- are mostly unemployed.

The locals mentioned that during the pilot project they learnt a great deal, since before they only dealt with dates traders by selling their dates in bulk. They learned better ways to take care of their dates before harvesting. They learned to cover their palm trees from the top with plastic bags, so that when dates fall off they fall in the bags. This improved the quality of their dates as they were protected inside the bags, and reduced their losses.

During the interviews with the locals, and to understand their perception of the building design I gave them some aspects and asked them to rate them in terms of priority. These were: aesthetics

of the building, design functionality and space divisions, project duration, sustainability, cost, and the pack-house capacity. Each interviewee gave a weight for each aspect in terms of its importance. On average, they cared about the interior space divisions and relationship of spaces the most. None of them gave high importance to the exterior architecture of the building. Almost everyone pointed out that the most important factor for the process was the cleanliness of the building, mentioning statements like "keeping the pack-house clean and protecting the dates from infection is very important", and "all these aspects deserve weight, but the most important thing for the quality of the dates we produce is that we keep the pack-house clean."

While I was interviewing one of the date providers at his house, his son and daughter were running around. His son, who was around six years old, never left us and was constantly playing around. I gave him my sketchbook and told him he can draw anything in it till we finish talking. He stayed silent for a while, then he showed me what he drew.



Figure 16: A Sketch by One of the Boys of El-Heiz

It was a boy harvesting dates from a palm tree, as he described it, and he said that this is him when he grows up. Their love for their village and how dates production is part of their identity,

that even a young boy sees himself growing date palm trees when he is older, was very inspiring. The people of El-Heiz always showed great pride when talking about their dates. They say they have some of the best dates in Egypt, and that they were very proud when they saw them packaged and ready to be eaten during the pilot project.

5.4. Design Development and Workshops at El-Heiz

5.4.1. Design Process

The design process was a series of discussions and drawings with the locals, producing plan drawings, and discussing them again with the locals. The design team was myself and Sara Harb who was also part of the class, and all class teams attended the workshops. This iterative process will be described in details.

5.4.2. Design Criteria

The initial design criteria was building a functional pack-house within budget that satisfies the locals needs. Throughout the workshops, more specific criteria were added which were providing maximum natural ventilation and daylight, outdoor space for smoking, a prayer room, and a renewable source of energy.

5.4.3. Design Concept

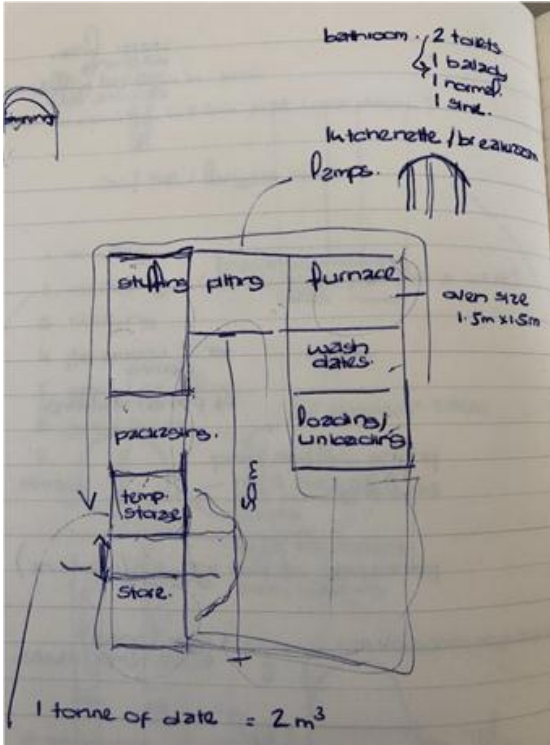


Figure 17: Zoning Sketch with the Dates Production Steps

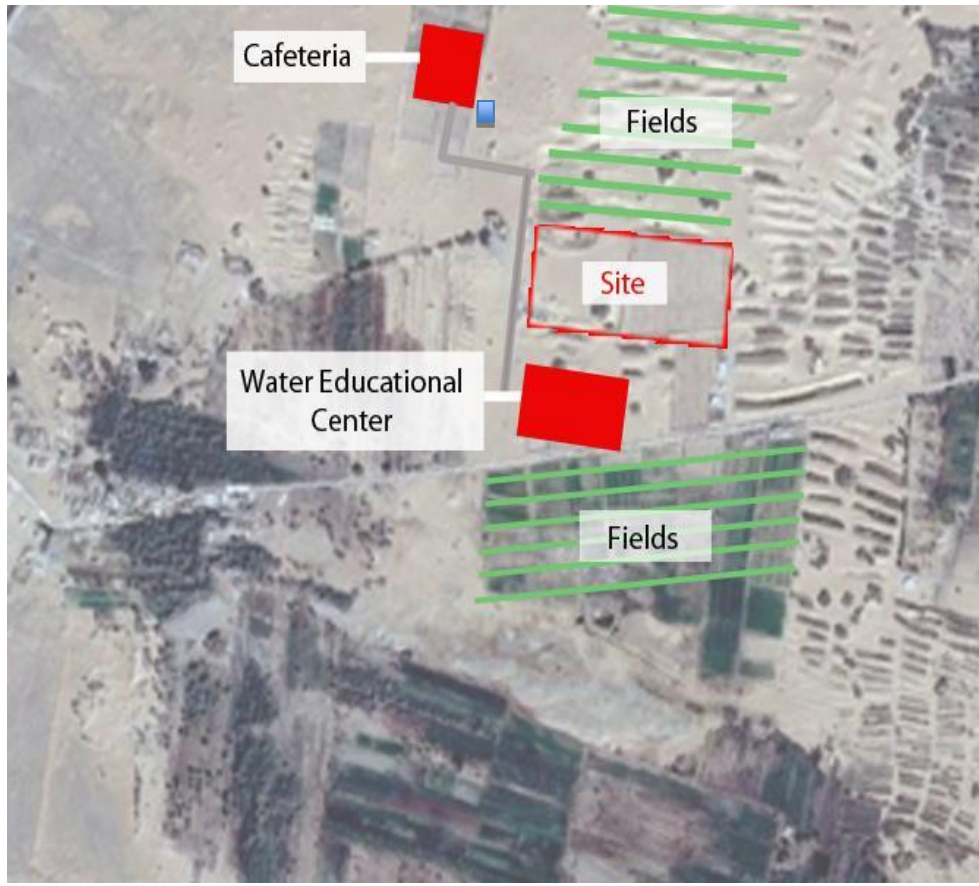
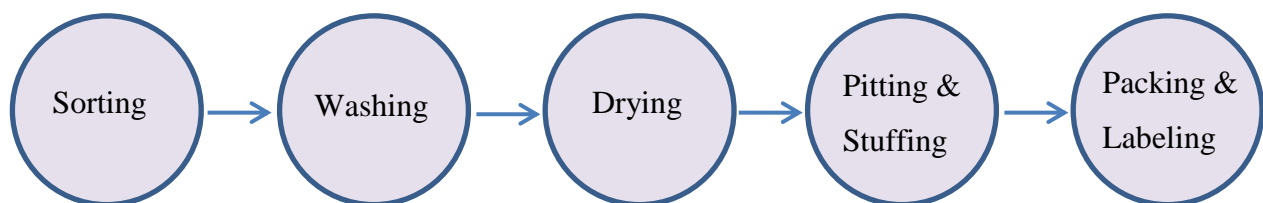


Figure 18: Site Layout

The design was developed through an inside-out approach, with everything following the process of dates production in order to create a building that is functional and comfortable for the users in every step of production. The aim was also to create a sustainable design using passive design techniques, especially because of the absence of regular electricity in the area.

The building design tried to be consistent to the process of dates production:



5.4.4. Stages of Design

Stage 1

When we first started the design, we knew from Freija that their buildings usually have palm leaves roofs, and they only started building with vaults and domes recently. For the dates pack-house to be licensed, we cannot have the palm trees leaves roofing since it would be porous. We visited El-Heiz to discuss the design with the people there. We did not want to have a solid design with us, but rather something visual to build discussions on. Rather than drawing plans, we just modeled a u-shaped building with the spaces following each other in the order of the dates production process. We had the changing room and toilets on the south. We also had a pathway followed by an external wall for insulation of the southern façade. We had a courtyard in the middle to be used as a break space, it was also the access point for the surrounding rooms to avoid going through the rooms to enter other rooms. We had domes and clear story windows in some rooms to make them cooler and to accentuate them.

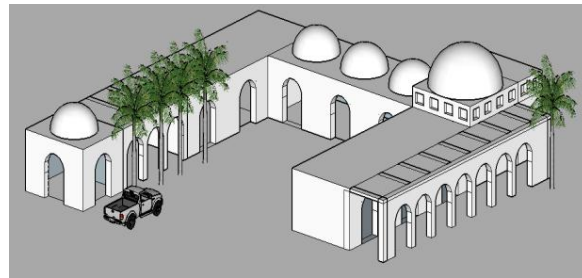


Figure 19: Pre-concept 3D Visualization

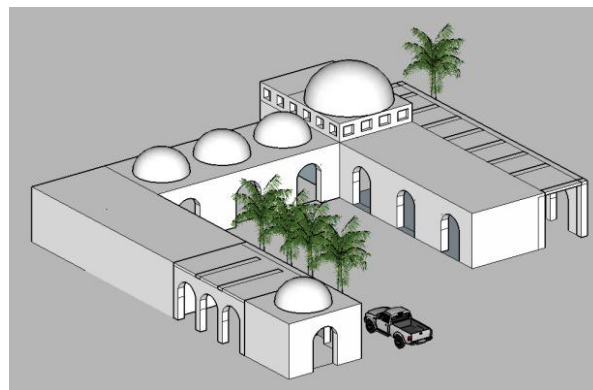


Figure 20: Pre-concept 3D Visualization

We had a conversation with the people of El-Heiz at the cafeteria; the people included land owners who are date producers, workers, and others. In this workshop, there was 25-30 locals attending. We showed the locals the digital model, and in the following stages we used to print out the plans to sketch on. When discussing the design with the people, we asked them on how we can divide each room. They started explaining how they do each activity. For example, pitting and stuffing is most efficient when they sit on long double sided tables. When drying, they need a room with good ventilation and another outdoor space because they use 2 types of ovens. We discussed the idea of having an underground room to keep the dates in, but the locals mentioned that even though there was no law that bans this, the military did not let them build underground in this area of the desert.

Since smoking is not allowed in the pack-house, the courtyard idea became very important. The workers also asked for a prayer room. We also asked them questions about how big the ovens needed to be, and how many people will be performing each function. The conversation sometimes turned into a discussion between the locals themselves. We finally gathered the information we needed about the process and the needs for the spaces. We came back with sketches and notes to redesign.



Figure 21: Design Workshop with the Locals



Figure 22: Design Workshop with the Locals



Figure 23: In-class Design Development

Stage 2

This was the stage when we started thinking of the building design in details of each space, using the information we got from the locals. The design process included discussions in class, interviews with professional architects all backed up with the information from the locals. The space for each room was based on the seating needed and the number of people. For instance, 24 people use the pitting and stuffing room, and they sit on a long double-sided table.

The U-shaped building idea was changed to a closed loop to have an entrance lobby that leads to the courtyard or the workers preparation room or toilets. Other than the rooms for each step of the process, there were two storage rooms: one for the harvested dates and one for the packed ones at the end. Also, there were toilets, preparation room where the workers change their outfits and wear the hygienic masks and gloves, and a multipurpose room. In this design, all working

rooms were accessible from the courtyard. Also, each room had connecting doors to the following one, so that if the workers are packing the dates then labeling them, they can directly move them from one room to the other. The protrusions in the building design were to ensure air inlets to maximize airflow. After working on this design, we discussed it in class through a series of internal iterative edits focusing on fixing the area of each space and windows locations. The discussion involved all class members-not only architects. This interdisciplinary approach to designing was very useful as it made us revisit the design considering technical aspects and financial aspects. While experimenting on the form, domes, vaults, and flat roofs were used.

At this stage, I met Architect Zeyad Amer to know about his experience with the water educational museum and get his feedback on the design.

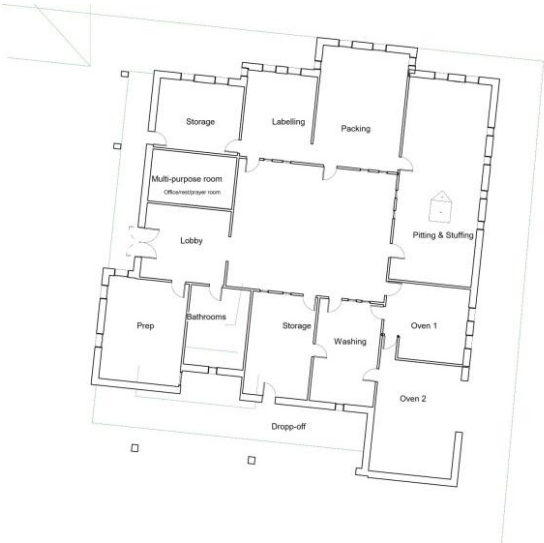


Figure 24: Dates Pack-house 3D Model in Stage 2

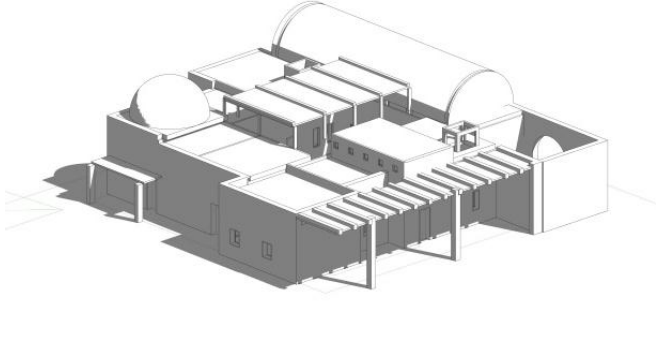


Figure 25: Dates Pack-house Plan in Stage 2

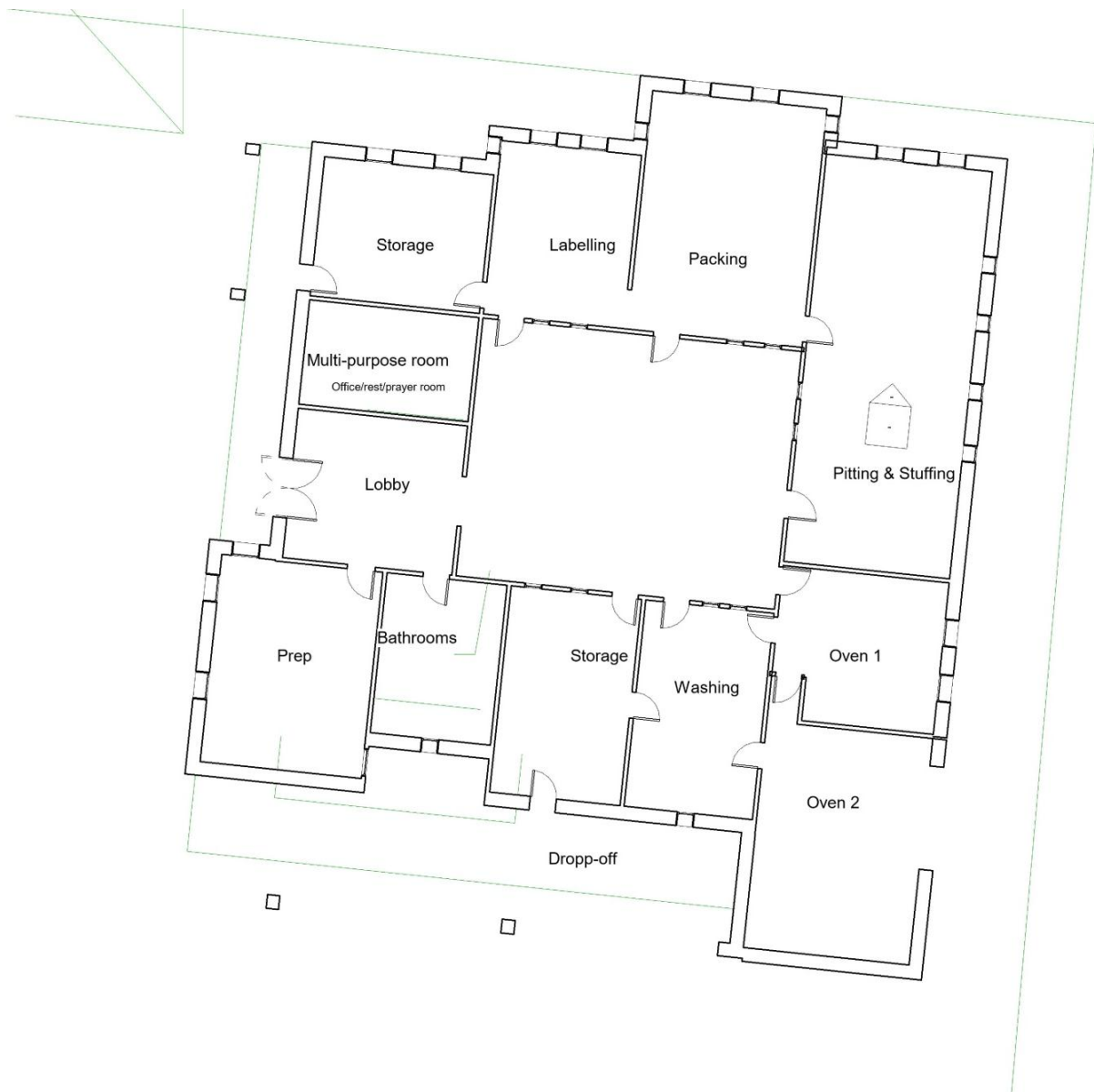


Figure 26: Dates Pack-house Plan in Stage 2

Stage 3

By this time, the financial team was done with all the calculations. According to the budget, we had to redesign the pack-house to be half of the area that was designed. It started again from there: the locals' feedback and the new constraints.

At this stage, the focus was to develop the design, and to make sure any design requirements for the pack-house license were met. The intention was to make the design compliant to the Global-GAP certification as well. For the hygiene of the pack-house, it is required to have it at least one

meter above the ground level. Also, the bathrooms have to be separate from the main working areas.

In the new design, the building form was broken up to maximize air flow, and the orientation of the building was facing the prevailing wind direction, with each room directed towards the wind. The separate spaces were chosen to be the preparation room and toilets to comply with the Global-GAP requirements. The location of the toilets was such that the wind does not blow any odors to the pack-house rooms. Also, the new design maximized the potential of future expansion.



Figure 27: New Baris Market Close-up

Thinking of both, unifying an architectural language and maximizing air flow, the design was changed to have vaults at different heights-inspired by Hassan Fathy's architecture, with openings that can let air and daylight inside. The separate workers preparation room was designed to be covered with a dome. The courtyard would be shaded with palm leaves so that it could be used as a break space in the sunny hot weather. Since we had to reduce the areas, we removed the multi-purpose unit, with the courtyard acting as an alternative space for prayer or any break activity. We had only one restroom with three toilets. This was because if women were to work in the pack-house, they would have separate working hours or days from men. When revisiting the design, the locations of the connecting doors were changed and some doors were removed so that we can maximize the use of the solid walls with the washing counters and other functions.

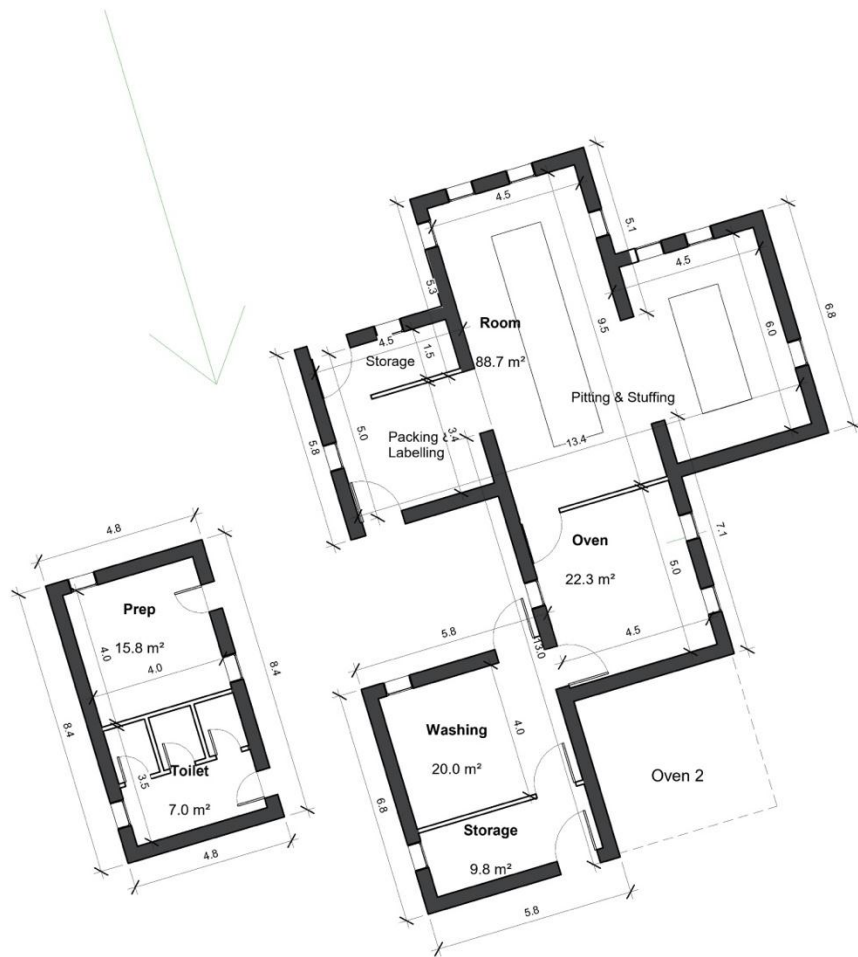


Figure 28: Dates Pack-house Plan in Stage 3



Figure 25: Dates Pack-house Elevation in Stage 3

5.5. Construction



Figure 29: Dates Pack-house Under Construction in December 2018

Even though delays in construction were expected, the construction process took several months more than what was planned. Workers did not do the whole building at once, they started with the foundation, and several weeks later, they started on the walls. They never really gave a specific date on which they can start building, but it was always dependent on when they finished the job they were working on, and when Tina went to pay them. Also, having different workers for the vaults coming from Aswan made the process take more time.

At first the workers said the building did not need a foundation, but after consulting several engineers, Tina asked the workers to build a foundation. The construction of the foundation and walls was done by a local builder who had a team of 8 workers working with him. The way the workers build was through outlining the floor plan on the actual location on site using bricks. The foundation was built out of limestone blocks, and it costed 95,000 Egyptian pounds. Since the building was not finished in the harvesting season (September-November), the dates were bought by Batran and Tina from the local date providers and stored till the pack-house was ready.



Figure 30: Google Earth Site Layout



Figure 31: Interior Photo During Construction

The process dictated changes in the design in the construction phase. The design was discussed with the workers who were going to build the pack-house. The worker responsible for the walls had no comments on the design. As for the one responsible for the vaults, he said he could not make openings in the front of the vaults like what was intended in the design.



Figure 32: Session with the Vaults' Builder



Figure 33: Sketching with the Builder

Through sketching together we decided to have two supports aligned with the windows (as shown in the sketch). It was important to have this discussion to avoid what happened in the water educational center, when the workers added columns in the large spanned spaces. The discussion with the workers helped in understanding the know-how of the workers and altering the design in accordance to what they could do best, rather than leaving the design decisions to be taken during construction when problems are faced, which might negatively affect both the functionality of the space and the aesthetics. The builder also mentioned that screens/meshes will be added to avoid insects, as well as openable glass behind all vaults openings so that it was controllable in case of wind or cold weather.



Figure 34: Vault Built with the Supports

5.6. Environmental Sustainability Considerations

5.6.1. Materials

The materials chosen for building the dates pack-house was natural stone. This is because stones were available close to El-Heiz, therefore it will not be long transportation distances. Also, having the walls made out of natural stone will improve insulation of the building. Since we cannot depend on consistent electricity, we tried to keep the building naturally lit and cooled as much as possible.

Despite these good reasons that justify using natural stone, they were still not used during implementation due to the following reasons:

- 1- For the dates pack-house to obtain a license in the future it must comply to health standards, the inside of the walls should be ceramic or an equally sealed material. Natural stones have the problem of having cracks in between them that allow rats and ants to pass through. To apply ceramic tiles on natural stones from the inside means using a lot of cement, which is not a good option either.
- 2- Another reason for not choosing natural stones was that they were an expensive option, and the project had a limited budget.
- 3- Only specific builders know how to build using natural stones, and these builders are outsiders not from the area.

With these reasons, it was decided by the investors to use white brick walls that the locals currently import from Minya. Surprisingly, the locals supported this option, they wanted to feel like they have a real factory, not like the cracked textured buildings they are used to.

5.6.2. Building Design

The orientation of the building was facing the prevailing wind direction. The building design attempts to maximize the flow of air through the form of the building and the court in the middle, to maximize natural cooling. Furthermore, all the roofs of the working spaces were vaulted. These should help keep the indoor spaces cooler as well. The toilets and the preparation spaces were located on the western façade at a location that guarantees avoiding the wind to carry the

smells. The initial dates storage area was located on the southern facade. Also, it was decided to shade the court with palm leaves. The locations of the windows were based on studies of air flow as well as the function and movement of the users inside. The rooms had different heights to enable having clerestory windows or openings in the vaults fronts in all spaces. All of these considerations were made in order to keep the building naturally cool as much as possible.

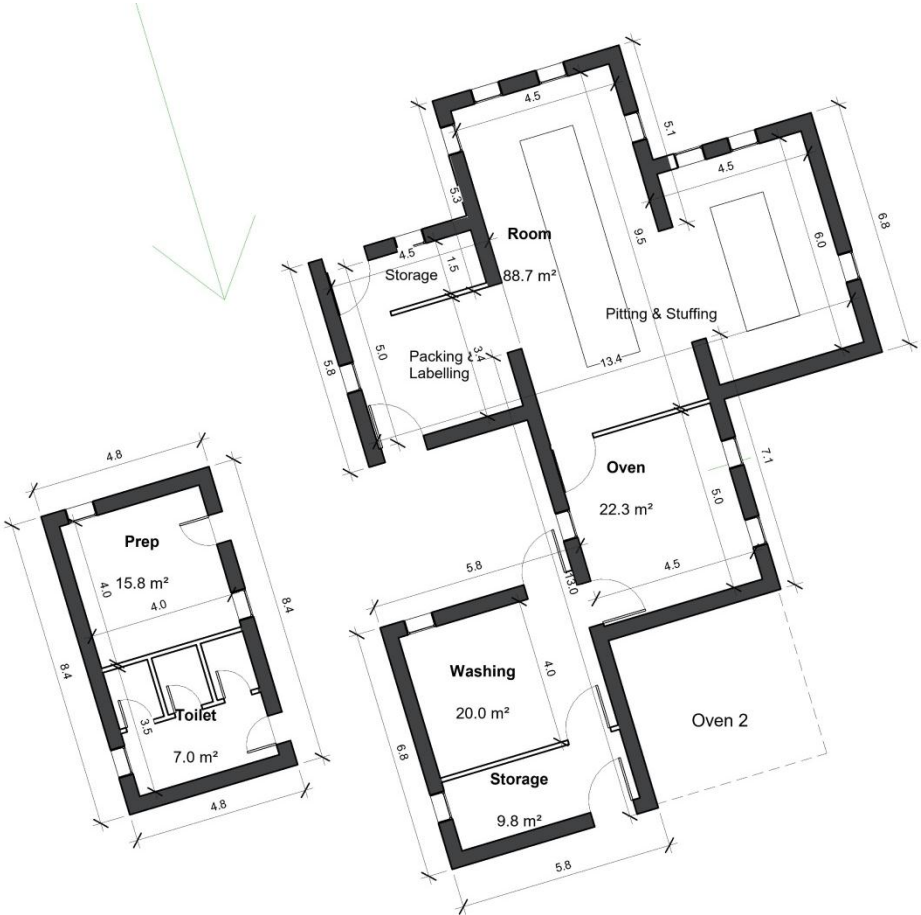


Figure 35: Dates Pack-house Plan

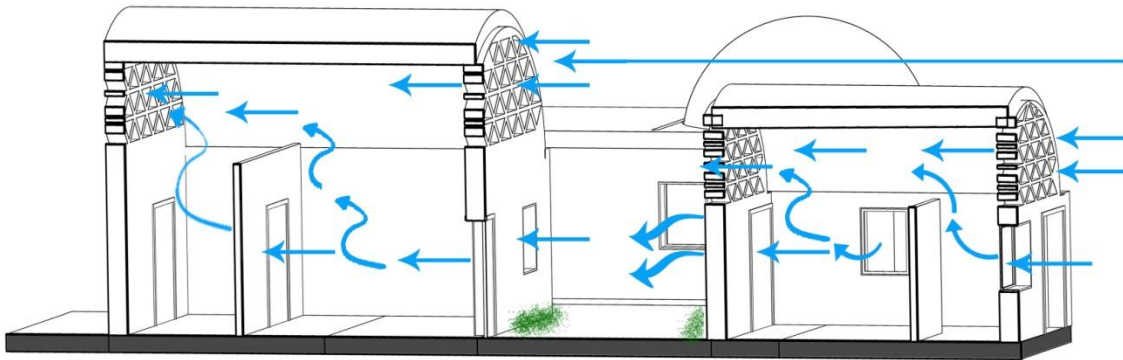


Figure 36: Natural Ventilation Study

5.6.3. Solar PVs:

With the challenge on site of having no supply from the electricity grid, and with the local generator only working for a few hours daily, it was important to find a sustainable source of electricity that would at least help in lighting up the pack-house in the evening. Hossam ElZayat, one of the class members working on the project, is a solar energy expert and he has a company making solar photovoltaic cells (PVs). He designed the location of the solar PVs to be on the south-east side of the building. They would not be on top of the building because of the vaulted roofs, but would be on the ground. This would also ease their maintenance. The aim was to create a power system that was large enough to provide energy for at least 6 hours after sunset with the lowest cost possible. The modularity of the PV system means that it can accommodate any future growth with additional energy requirements. Even though the PVs were on the ground level, they could still be relocated in case of expansion in this direction or any changes happening on site.

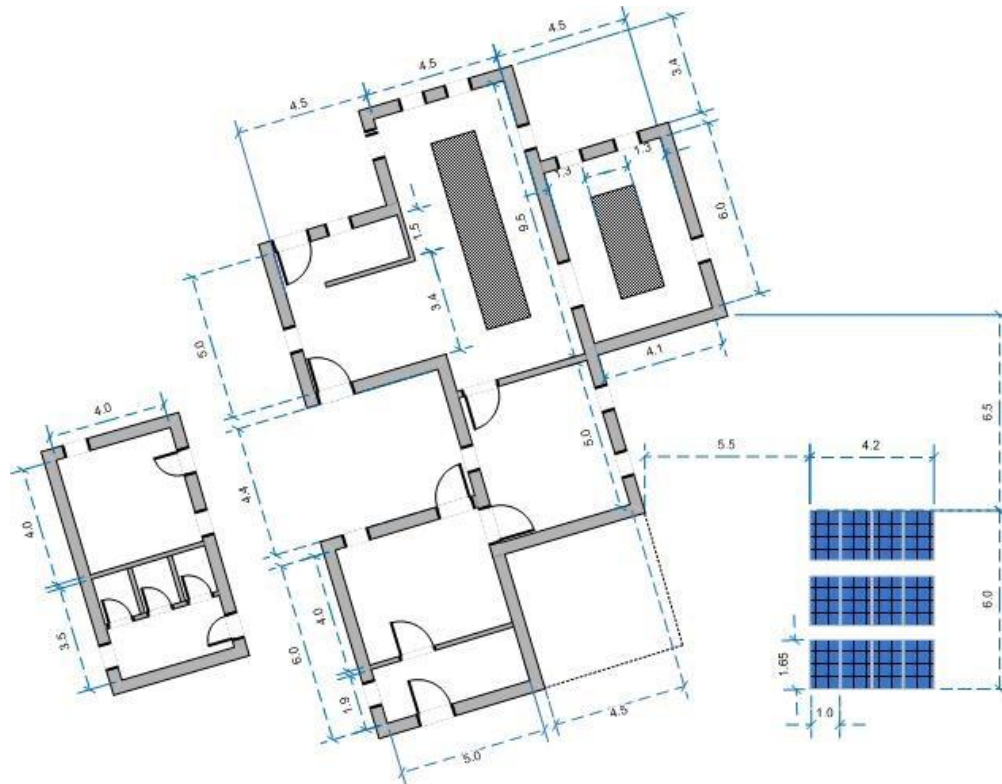


Figure 37: Plan Showing the Location of Solar PVs

5.7. Challenges in the Process

5.7.1. Women Employment

When talking to the men and women of El-Heiz, the major role that women play in the village became very clear. They produce most of their daily consumable materials contributing to big savings in the family's expenses. Women at El-Heiz produce 50% of the household consumed products. They bake their own bread, they raise chicken and ducks, they cook, and they are responsible for cleaning the houses. Not only that, but they also executed 80% of the post-harvest work for the pilot project of dates packing, after men did the harvesting, it was the women who had the biggest burdens of sorting and drying. According to Batran, if it was not for the women at El-Heiz, the pilot project would have failed.

In the pilot project, there was still lack of knowledge of the best practices to preserve the produce. Due to having a large amount of dates in the pilot project with a risk of infection, one of the locals took Batran and Tina to his grandmother who explained their ancient technique to

protect the dates. After the dates are washed and dried, they are roasted in wood fire and mud brick ovens. 3 minutes roasting of the dates is what the women at El-Heiz do to avoid insects or worms infections. This preserves the dates, without the need to fumigate.

This incident brought up the question of what the tasks division in the dates pack-house would be. Will women -who never go out except rarely when visiting outside family members- be allowed to work in a dates pack-house? Several options were brought up during discussions at El-Heiz between the locals (men and women). The option of having separate days or working hours for women in which they were alone in the dates pack-house sounded like the most reasonable option. Women would do the sorting, washing and drying, while the men harvested. Then the women would do the pitting, stuffing, packaging and labeling. It is yet not guaranteed that enough women will have time and agree to work there, and that men will accept the idea of their wives working outside. Some women already work in factories in Bahariya, so the idea does not seem impossible, but this is not the majority.

Another option was to assign women some tasks to be done at homes, while men do others in the pack-house. Since women's contribution was essential in the processing of dates, especially that they were the ones experienced up to the drying and roasting stages, this option could not be excluded. However, it caused issues of losses of dates and increases in the costs for the transportation of the dates from the houses to the pack-house for the rest of the process.

The third option was to have men do all the tasks instead of women. However, the women's contribution to the process proved to be the biggest asset in the pilot project because of their expertise, so this option was not favored by any.

I have witnessed a very tempered argument while being at El-Heiz cafeteria regarding this issue. It all started when Tina and I asked Ahmed (not his real name), one of the men whose wife was involved in the pilot project, if he would be okay if his wife worked in the pack-house or not. His answer was that she won't have the time, and that they were culturally segregated too. So, we asked if separate half day working hours for women would solve the problem. Ahmed said it would be okay. Then suddenly, Mostafa, who was one of the locals having some tea in the cafeteria yelled, "Nor you nor any man here will let his wife go work outside the house." Ahmed replied that it will be a segregated working place, and Mostafa said he bets when the day comes

Ahmed will never let his wife work. Then Tina asked why when time have changed and traditions change too. Mostafa very angrily said they never change their traditions. The conversation went nowhere, leaving us knowing that we might have some production activities happening at the courts of the houses by the women.

When asking women who worked on the pilot project if they will be able to work at the pack-house, they explained that it was more a matter of time rather than allowance. The problem was not that they were not allowed to, but they didn't have the time to leave their homes and go work outside. They were capable of working at home, because they could do it while watching their kids, and cooking in between. They can multi-task at home, with all the responsibilities that they have, but they could not afford to spend several hours outside their houses. They mentioned that some other women in the village were not married, or have less responsibilities so they could work in the pack-house. One of the women mentioned that maybe young men can do the work instead.

Given the fact that the locals (men and women) are used to women working from homes, it would have been ideal if parts of the dates packing process were to be done at homes and other parts by men in the fields. However, the pack-house is essential because without it, supermarkets will not buy the packaged dates since supermarkets require dates from a licensed company, and licensing requires a pack-house with specific standards.

5.7.2. Electricity Supply

At El-Heiz, electricity is available only for minimal municipal lighting; there is no power for refrigerators, and is available for six hours a day only, from 6:00 pm till 12:00 am. There have been projects to light up the houses through getting energy from solar panels, but these were only installed in around 10% of the houses. This continues to be one of the main challenges for development in the village.

5.7.3. Budget Issues

Similar to what happens in several projects, there were several compromises to cut down the cost. At first, the design of the building was double the area in the final design. Then, the

financial team in class started calculations based on the prices of materials and construction to develop an estimate of the maximum area we could afford. The building was redesigned to have all the functions with a smaller area. After reaching the final design and building the foundation for the building, Tina and Batran decided to postpone building the left wing of the building since they were going above budget. This meant that in the beginning of operations, toilets of the water educational center will be used instead.

5.7.4. Building Materials

Choosing building materials was challenging, and up until construction, not everyone agreed on the materials. As discussed earlier, the building material decision was finally changed from building with natural stones to white bricks. While the use of white limestone bricks in the desert may not seem as the most sustainable choice, it meant that smaller amount of cement will be needed than in the case of natural stones, the construction workers would be from the locals, and the cost would be cheaper.

5.7.5. Fridge Crisis

Because the process of building the pack-house was taking more time than it should have, Batran and Tina bought the amount of dates they were supposed to buy at the first stage from the people, and decided to store it till the pack-house was ready. The dates were roasted and ready to be stored in fridges. The place where the dates were going to be stored in rented fridges cancelled the deal, and Batran and Tina kept looking for other fridges to rent to store the dates but could not find. This was a crisis because the dates were in risk of infection. At this point, they decided to build a fridge, which they did, and had one at a temperature from 4 to 7 degrees Celsius which is optimum to store the dates. The fridge was built at Bawiti because it is the nearest place that has electricity all day. The fridge has four tons capacity, and it costed around 85,000 pounds.

5.7.6. Hygienic Standards

While each team in the “Implementing Green Technologies in Local Communities” class was working on their different parts, Tina explained to us that to be able to sell dates in several shops,

the pack-house needed to be licensed under a legal company. To ease the licensing process and to abide by high health standards, Tina mentioned that we will aim for the Global Gap certification. When starting the design, the basic design requirements that we knew from Tina in class were to separate the toilets from the working zone and to have the building one meter above ground level. These were respected throughout the design process. Later in the design process, after design stage 3, we discovered that the sanitation space has to be attached to the working zone so that workers are not exposed to any pollution from the sanitation room to the work space. Initially, we intended to have the sanitation zone inside the preparation room that is attached to the toilets and disconnected from the rest of the building. Knowing that this should not be the case, the design was adapted so that part of the courtyard was closed from the top with a flat roof, and arches with floor to ceiling glass were used to close that part of the courtyard while keeping the openness feeling. These are all future plans, since in the first construction phase of the building, the toilets and the preparation room wing will not be built due to budget limitations, so the workers will use the toilets and leave their belongings in the adjacent Water Educational Center, and we will have a small sanitation corner in one of the rooms. Changes in the design could have been avoided if the standards were checked from the very beginning, but the main focus at that stage was to understand the way people do the process, that the standards were omitted at that stage. Even though that was not intended, the closed part of the courtyard provided a cleaner and cooler break or prayer space for the workers.

6. The Participatory Design Process

The analysis of the process followed a thematization approach. Themes were identified through identifying repeated patterns emerging from the analysis of the gathered data. The main stakeholders in the participatory design process were: locals, women in particular, the researchers who are also investors, and myself as a participant observer in the process. First, the role of each of them was identified, as well as details of their involvement in the project. Stories that highlight critical situations in the process were analyzed, and from these, themes were identified. Finally, the findings from analyzing the process were compared to literature.

6.1. Researchers and Investors

Professor Tina, is an Assistant Professor of sustainable development at the School of Sciences and Engineering at AUC, and a researcher at the Center for Applied Research on the Environment and Sustainability (CARES). She has been involved in projects in ElHeiz for the past 6 years, specifically the water educational museum, the solar powered water station, along with a new research on wind energy in the desert. Like she does with all her students, Tina lets everyone in the village call her with her first name, never with a title. Tina is very popular in the village. She would often bring the kids to the Water Educational Center, and sing with them educational songs that she makes up to make the information stick in their heads.

She was teaching the “Implementing Green Technologies in Local Communities” course in Spring 2018, and that was when I was introduced to the project. The first time the class went on a trip to El-Heiz, everyone was so uncomfortable not used to sleeping in small dark rooms with no electricity, no bathrooms, and nothing but a bed and lots of insects and spiderwebs. Tina slept well and woke up so relaxed, missing her donkey, a donkey that one of the locals gifted her with after the completion of the Water Educational Museum. All the class members were so impressed with how she enjoyed the nature around her and appreciated the peaceful primitive life. Throughout the project, I have been witnessing the conflict between Tina’s optimism that we shall finish the project and the pessimism of other professionals I interviewed who thought it will take more time than we think.

Tina generally is part of the team at CARES working to develop the village of El-Heiz and carrying out research projects there. In this project specifically, Tina's role was to divide tasks among class members, to follow up on our work, and to help in arranging workshops with the locals since they knew her. Added to this, she was the funder of the project, together with Mohamed Batran.

Batran is working on this project as part of his PhD in economics. His family owns the Batran company that owns a smaller company called "The Desert Caravan" which is funding the project with Tina. He has been working with Tina on this since the start of the pilot project. He has been taking care of all the financial and legal issues. When talking with the locals, a couple of them mentioned that Batran paid them well in the pilot project. Batan is very passionate about the project and about the involvement of the locals, and especially the women; and that came out clearly in all the interviews I had with him throughout the project.

Everything about managing operations was the duty of Tina and Batran such as buying dates and renting fridges. The fact that Tina who is a researcher in CARES, and Batran a PhD student working on the project, both being the only investors and funders was something that definitely impacted the decision-making process in a way or another. On a positive note, it made them very concerned with the practicality and sustainability of the project. In some cases, projects were not sustainable, because they depend on the researchers, who leave when their research was completed, and thus are sometimes accused of doing the research for the sake of degrees and conferences not for community development. Having Tina and Batran as investors made sustainability a top priority because they wanted the project to make money for them and for the farmers in the long term. Another thing was that Tina has been working on other projects with CARES at El-Heiz, such as the Water Educational Center and the solar powered water stations. This made her very trusted in the village, and encouraged people's participation.

On the other hand, this might have resulted in the participation of some people more than others, specifically those involved in previous projects. Also, the fact that Tina and Batran were both the researchers and the investors gave them so much power in terms of decision making. In all decisions -other than setting the budget- Tina and Batran were democratic. In the design process, the opinions of the locals and architects were integrated. Through discussions we usually came out with one thing we all agree on. The only time when discussions never led to consensus was

when we exchanged views on whether women can work in the pack-house or not. There were arguments between local men saying that girls just want to get married, not to work in factories, and Tina saying that times have changed and girls should aim for more than marriage. In the end, she could not change their minds, and the plan of working in the project will be according to their traditions.

6.2. Locals

People of El-Heiz have always been very welcoming to me and every visitor that comes to them. They were used to tourists stopping by to take a break or camp for a night on their way to the White Desert. In the interviews with the locals, “We have the best dates” was a repeated statement from several of them. This shows how the locals were all proud of their dates, and they also expressed their excitement for the dates pack-house repeatedly. For some reason, the locals trusted us. In the interviews, many mentioned -in different ways- that they were sure the pack-house will bring benefits to their village. This trust could be because of the shared relationship between them and Tina. It could also be because they have trust in themselves, and know when they work together on this project, they will succeed. People of El-Heiz have a very strong social capital, and the level of cooperation in anything they do is impressive. In the interviews, the people knew what they wanted in terms of space divisions and what rooms should be close to what. This helped in creating a design that was based on the users’ needs and the local dates production process.

Another interesting point I noticed through the interviews was that the locals had this habit of passing knowledge to each other. The land owner, who was also part of the pilot project mentioned to me that after trying to cover the palm trees tops with plastic bags and seeing how this improved the quality of dates and saved losses, they started teaching other farmers to do that. This culture of the farmers passing knowledge to each other contributed to the sustainability of the project.

6.3. Women of El-Heiz

Women of El-Heiz play a huge role in the village. They have extensive household duties including baking bread, cooking, cleaning, and taking care of their kids. They also do the initial sorting before selling the dates to traders. In the pilot project, they were sorting, washing and drying the harvested dates. They introduced Batran and Tina to the roasting that they do instead of fumigation, which saved the dates from infection in that phase.

Women of El-Heiz spend most of their days in the courtyards of their houses where all the women of the family gather. They are very conservative and are rarely seen outside their houses. Freiga, the land owner, was welcoming to a visit by Tina and I to speak to his wife who was part of the pilot project. We also spoke to his grandmother, who was the one to tell about the roasting technique. The courtyard had several other women of the extended families, some of whom were part of the pilot project and some not. In a focus group, the women started explaining the process. They did not place the most importance on design feedback, but most of the conversation was about whether they could work in the pack-house or not. The women explained that they were very busy. Freija's wife said it was difficult to afford several hours to go to work outside; they could help with the work from their homes, and she mentioned that young men can work in the pack-house, which will be great since many of them were unemployed.

In all the visits to El-Heiz, I have never witnessed a woman outside her home except once, and in that one time, the woman covered her head and ran inside once she noticed there was a truck full of people passing by. Not that I saw large numbers of men either, they were usually inside the fields harvesting or feeding the animals, or in their houses. The unpaved roads of El-Heiz were empty most of the time, but whenever someone was seen anywhere, it had to be a man. Tina was the only woman actively present outside, and lately myself too.

When discussing the idea of women working in the pack-house, most men would angrily refuse, mentioning that they did not allow their women to work outside their homes. The way women see it though, was that they cannot work in the pack-house, because they have a bigger role in their society. Whether women were really in control of their decisions, and they preferred to stay home because they see that men could not do their jobs with the house and the kids, or women were only feeling in control when in fact they were controlled by men is questionable. What is

unquestionable is that their role in the village is extensive, and their role in the pilot project was huge as well. They proved that they have to be part of the dates production process for it to be successful.

6.4. Myself as a Participant Observer

My role in the project started in class when Sara Harb and I were the architects designated to design the pack-house. From the beginning of the course, I decided that my role would not stop by the end of the semester, but I would take it forward to continue the design of the project while documenting and analyzing the whole participatory design process from the beginning till the end.

Being a participant observer in the project, I had to separate my roles between observing and documenting what was happening, and participating in the process. I came into this process with expectations and thoughts, and left with others. Throughout the process, I started to question everything. I was surprised by how easy it was to get a piece of land and build on it. Being in the middle of nowhere, with desert all around, one just picks a piece of land, ask about it, and if a family owns it, pays a small amount of money and rents it. Yet, I was surprised by how much the construction process takes time, because it depends on when the workers are available. The way they build was so much different from what I expected. They do not have architects and the sites are not supervised by engineers. Yet, the people are so good at imagining what they want, explaining it to the builders, and the builders do it right away. I thought the locals will be inclined to building with natural stones since it is locally available, but they did not seem to have any preference to materials for the pack-house; all what they mentioned was that they wanted it clean. Being the architect, I prepared myself to never be defensive to the design, and be ready to go wherever the process takes me. In some moments, I did not know if “yes, it is very nice” was a courteous statement from the locals or a real opinion, but their objections on other things in the design and their special requests brought me peace that they were ensuring the building will be the way they want it.

7. Sustainability of the Dates Pack-House

The sustainability analysis is a triple bottom line analysis in which the environmental sustainability of the architectural design output was analyzed, as well as the social and economic sustainability of the project. With this triple bottom line analysis, the whole sustainability of the project is discussed.



Figure 38: Three Pillars of Sustainability

7.1. Environmental Sustainability

Design

In the design of the pack-house, passive design techniques were used to maximize natural ventilation and cooling. Also, all the exterior walls of the building are double walls with air cavity in between

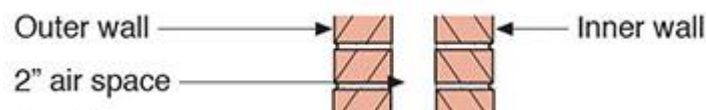


Figure 39: Detail of a Wall Section

Building Materials

Building with white limestone bricks is not considered sustainable since these materials are not available locally and are transported for long distances. However, using local natural stone would have required a large amount of cement to fix the tiles (required for licensing) on the

walls, which was not environmentally preferable either. Therefore, the best economic option was chosen which was building with white limestone bricks. The building was built with brick walls, and vaulted brick ceilings. The finish from the inside will be ceramic tiles for both the walls and floors.

Greenhouse gases emissions, Energy and Water

The building uses renewable energy through solar panels. This serves both not harming the environment and the ability to maintain operations in the pack-house regardless of electricity supply. The solar PVs will generate 10 KW/hr per day, which was estimated to keep the pack-house running for a minimum of six hours per day. The cost was estimated to be 51,000 Egyptian pounds.

Furthermore, the short-term plan is to use the waste water from washing dates for irrigation, and the long term plan is to treat this waste water so that it can be re-used for dates' washing.

Waste Generation

The target is to have less than one ton of waste per year emerging from the pack-house, and to develop a waste management program for that. Waste will be separated at disposal in the pack-house, and plastic waste will be sold which will also slightly increase the cash in. There will be zero food waste, even the seeds of the dates after pitting will be used as soil fertilizers in the future. In the sorting stage, all the removed dates are used for making *agwa* (date paste). People of El-Heiz usually sell the *agwa* after the dates season. It is another source of income for them, since there are several *agwa* based products such as cakes and biscuits filled with *agwa*.

7.2. Social Sustainability

Employment

The project employed young men for working in the construction process. It is estimated to employ around thirty workers for the first phase of dates production. Every year, the amount of dates that will be processed will increase, with the increase in the expertise of the people

working, more dates can be processed, and more people will be employed. This gives people of El-Heiz additional work opportunities.

Participation

People of El-Heiz not only attended workshops when we asked them to, but they were extremely welcoming. The first time we visited as a class, they welcomed us with a music night in the cafeteria where they drummed and sang, then spent the night talking to us about dates production. Even though women never go outside, the men invited us to visit them at home, and the women were active in the discussions as well. The motive for participation is very important. There were no monetary benefits for participating in the design process, yet the locals participated because they believed in the benefit of the project to them. There were also diverse participants in the process: young men who will be workers in the pack-house, older farmers who will be dates producers, and women, so the sample reflected the various segments of the community. Men's involvement continued to the construction process in which they helped in building and continued to give feedback on minor issues during construction. Women's involvement could not have reached the construction process because their involvement had to be inside their homes.

Sense of Ownership

The fact that the date producers and the workers share in the profit with the investors, along with the fact that the building was designed with the locals and built by them, gave them a sense of ownership. The locals have been taking photos of each other in front of the building. Earlier, several of the locals offered to help in anything needed during construction, before knowing that they can get paid for working with a daily fee. Also, during the interviews, they mentioned words like “our dates are very clean”, “we have the best dates”, “the packaged dates last year looked so good”, “when we work in the pack-house we can produce more dates than last year”. The workers were proud of their dates, and looked forward to do the process again on a bigger scale.

Women Involvement

Women were involved throughout the participatory design process through focus groups in the house courtyards. Women will also be involved in the dates production process of the pack-house. Women specifically work on sorting, washing, and drying. Working in the pack-house will give women their own source of income, even if they work from home, similar to what they did in the pilot project.

7.3. Economic Sustainability

Structure

Tina and Batran are the funders for the project with Batran's company 'The Desert Caravan' the official owner. Batran rented the land from the local owners for 49-59 years which started in 2018. This is what they agreed on, but the contract is still not signed. This ownership through long-term renting of the land is because Batran and Tina needed a piece of land to initiate the project, the locals wanted to have the project so they wanted to offer a land, but they still wanted to keep the land for the future generations, so they did not want to sell it. This means that in the initial phase of the project, which is the phase of the contract, the building itself is officially owned by Batran's company, whereas the profit is shared. In the future, when the contract is over and the project has been running in the village for several years, the land with the building's ownership will be to the people of El-Heiz, who will probably be another generation. Having the land owned by a company facilitates the licensing process. People of El-Heiz still have the sense of ownership of the project, because 50% of the profits goes to them, and because they have not only witnessed the building come up the way they wanted it to be, but some of them even helped throughout the construction process.

Operations

When the team checked the market in the time of the pilot project (2017), the prices of similar Siwan dates in the market were between fifty and a hundred Egyptian pounds per kilo, depending on whether the dates were plain or almond stuffed. In the pilot project, the plain dates were sold for ninety pounds per kilo, which was very expensive, yet it was sold because it had better packaging, the dates were very clean and accurately sorted, and the roasted taste was unique.

Normally, the farmers make seven pounds per kilo when they sell the dates in bulk form. When packed they can sell it for fifty pounds. The farmers' income represents 14% share of the final price at fifty pounds per kilo and a 7% share at the hundred pounds per kilo. In the pilot project, the farmers made 21 pounds per kilo for the plain unpitted dates, instead of 7 pounds, without paying for any of the post-harvest costs.

As for the workers, in the pilot project, Batran asked about the wages. It ranged from 80 to 120 Egyptian pounds per day. He used the highest number (120 EGP), divided it by the regular 8 working hours, to come up with an hourly rate for the workers of 15 Egyptian pounds. Workers who came for 8 working hours per day were paid 120 Egyptian pounds which included almost an hour and fifteen minutes to an hour and a half lunch and prayer breaks. Any extra hour was paid with the hourly rate. In the interviews, a couple of the workers mentioned -without being asked about this- that they were satisfied with the pay in the pilot project. Men and women will have similar hourly rates, just like what happened in the pilot project.

In the pilot project, dates were bought from 4 farmers, the following year (2018), dates were bought from 6 farmers. This encouraged all farmers in the village to start adding plastic bags around their dates on the palm trees, because they learned that this will protect their dates, reduce their losses, and because they knew that every year more farmers will be able to process their dates in the pack-house. Gradual expansion is expected to continue in the project till the whole village can process their dates. Profit is shared between the investors, date providers and workers: 50%, 40% and 10% respectively. The investors also buy the dates from the dates providers in the beginning of the process with the intention of eliminating any risk on the locals.

Future Expansion

It was agreed with the locals to use profits in the future for expanding the pack-house to increase its capacity and increase production.

8. Emergent Themes

8.1. The Expert Role Rotates throughout the Process

When the construction process was starting, the builders just wanted to build without a foundation, like they usually do. At first, Tina accepted, but the researcher explained that the foundation is essential for the building to stand and be structurally sound. There were massive arguments around this with Tina; the workers said that was how they always built and they knew what they were doing. To me and the engineering class members explaining differential settlement and how the wind over time can lead to cracks in the building was quite a challenge. In the end, after Tina consulted several architects and structural engineers, she asked the workers to do the foundation.

This shows how each of the participants, the builders, architect, and investor, come into the process with their set of information and their way of doing things. The process allowed for an authentic exchange to happen, yet the decision had to be taken by the person in charge of funding.

In an interview with one of the dates providers, he literally mentioned that the foundation of the building is very important, that he was so glad we made a foundation because builders there do not do that, and the soil usually settles after some time. The local builder also mentioned that it was his first time to build a foundation, and that even though he did not want to do it this way in the beginning, he was glad he did it for his first time.

The process has been a loop of sharing information among each of the participants. In the situation of whether to build a foundation or not, the role of the expert was played by the architect. Whereas in the design process itself, the exterior of the building was an architecture decision, but everything about the interior was coming from the knowledge of the locals. The locals were the experts who knew each and every step of the dates production process. They were the ones setting the design criteria, deciding on the proportions of each room and the sequence of the rooms. The locals were the experts teaching everyone about the dates production process. When it came to the exterior of the building it was not an area of interest of them so they gladly relinquished decisions on it to the architect.

In the construction phase, the local builder learned to build a foundation for the first time. Everyone has been learning something, and the way the process went was not through a group of experts implementing a project in a village, but professionals working in partnership with the locals in a village with the role of the expert rotating between them according to who had the knowledge needed for every situation or decision. The relationship of trust that was clearly present between the research team and the locals had a lot to do with the acceptance of the various parties of that revolving roles. There was no intimidation when one of the participants influenced more the decision in one of the stages, as one may expect from parties that are so diversely different.

8.2. Local Perception of a Building

There were several discussions with the locals about the design of the building. Discussions included both the exterior and the interior design of the building. The locals' usual comment on the exterior of the building was that "it is nice". When hearing the design suggestions of having vaults and domes they said that they like them. They did not mind the building materials, they just wanted something clean from the inside. When we got to the inside of the building, the conversations got very controversial. They asked for a prayer space, smoking zone, and had spatial requirements for the functional rooms. They explained to us in great detail the steps of the functions they do for dates production so that we follow them in the design. They also discussed possibilities for future expansion. They requested an indoor oven and a space for an outdoor one because they use two types of ovens. There were discussions between themselves and discussions with us. On the other hand, they rarely commented on the aesthetic factors of the building. Their comments seemed to focus more on what makes them most comfortable. A building to them is what shapes their movement from within, and what is both functional and comfortable. Facade design is of much less priority to them, that they left most decisions to professionals to decide while only mentioning that they generally like vaults and domes and that they wanted a building material that helps keep the inside clean, which were requirements that still related to the inside of the spaces.

This change in the level of participation between both topics exterior and interior design, indicates that where the interior is concerned, the locals believed they were the experts, and they

knew how it should be and we should work accordingly. Whereas for the exterior, they left it to us, it did not seem to be as important to them. A building to them is more about how well the spaces served their functional needs rather than how it looked.

8.3. Priorities of the Architects Change According to the Context

In the professional life, the priorities of the architects change according to the context of the project. For example, if the client for the pack-house was a professional company, the design would have gone by the book, getting all the systematic steps of the dates production process and studying all the design standards to build the design upon. However, in the case of El-Heiz pack-house project, the focus was on the traditions of the people, on local dates production, and on the culture of work division between men outside and women inside the houses. Designing for a large pack-house that could take both men and women for example would have been useless, so it was essential to understand the culture. While hygienic standards should have been studied from the very beginning as well, they were the second step after understanding the local way of doing the process. As architects we altered our normal process of starting with the standards, because the context offered what were clearly far more important constraints that had to be understood and resolved. The context of each project sets the priorities for the architects.

8.4. Gender and Dates-Packing

People of El-Heiz are very conservative when it comes to women, yet this does not mean that women do not work. Inside their homes, along with all the house and family duties, women always do the initial sorting of dates before they are sold to traders at home. The role of women at El-Heiz is very important. In the pilot project, they were the ones who had the knowledge of the roasting technique followed by cooling that was done instead of fumigation which saved the dates from infection. Men understood well the role of women; through talking with several men, they mentioned that the roasting technique dates back to their grandmothers. They also mentioned that women save them a large amount of money because they produce food consumptions at home. When it comes to the dates pack-house, the input of women was clearly essential, as demonstrated in the pilot project. Their involvement will be significant for the sustainability of the project. Ideally, the dates pack-house will have women working days.

However, this is clearly a concession the men are not all ready to give in to. The question thus presents itself, if men are so ready to acknowledge the important role of women, why do they still insist to limit their movement in public, and the answer is: culture. If women end up working in their homes, this will entail some additional costs and activities in the production process. For now, this will have to be a decision that is postponed for a later stage in the project.

9. Concluding Discussion

9.1. The Architect as a Participant Observer: Experience and Lessons learned

The way architects design buildings is different from how the locals do it. At El-Heiz, the process is very simple, several design decisions are taken on site while building. This is different from the professional architectural process of producing a full set of construction documents before embarking on construction. When different mindsets work collectively, they meet somewhere in between. Throughout the participatory design process, the researcher got immersed in the world of the locals as the process pulled me in. While on the other side, the locals explored more the architectural way of designing through modeling and design workshops. This formed a new relationship that stands in between the rules of the architect and the spontaneity of the locals. The researcher did not produce detailed construction drawings, but we had schematic plans and elevations printed and discussed with the workers, then they started construction from there. There were things that were not discussed such as the connection between vaults with each other, and the windows sill heights and details. This left space for the locals to take decisions on site and apply their traditions and preferences. Even though there were assumptions on what the workers will do in these non-discussed small details, assuming the builders will do things in a specific way was not accurate, because local builders have their own standards, and often that may mean that the standards vary according to builder. It is important to realize that people have their different traditions even when it comes to construction. Architects have their traditions and local builders have theirs. This process brought both traditions into interplay

Also, there were some infractions from the design in the construction process. For example, in one of the spaces, the locals changed the shape of the vault's openings from the patterned openings in the drawings to an operable window. It was their view that this was a more practical solution. This overscored the feeling of ownership that the locals must have developed to the building throughout the process, which will inevitably have its impact on the overall sustainability of the project.

This special relationship that developed with the locals and having a hands-on experience being a participant observer was very enlightening and transforming. Participant observers have to allow other participants to act freely, even if they are criticizing their own input without being defensive. Throughout the participatory design process of the pack-house with the locals, I learned to be a facilitator enabling the locals to design for themselves. I learned to listen and open up to the fact that non-professionals may know better, or even more, about the design requirements than I did. Practicing to be observing without interfering in the discussions and without acting as the expert is very challenging when the discussions are in your area of expertise. Being a participant observer involves the challenges of balancing between when to participate and when to only observe, of controlling your biases, and of understanding that you are affecting the process, since you are one of its participants. During the design workshops of the pack-house, there were times when I participated with my input in design, and there were other times when I was observing the discussions between the locals while they were discussing what they wanted focusing on taking notes. This observation was important and it helped in interpreting their needs and identifying patterns of behavior and preferences among the people.

The role of the expert changes throughout a participatory design process, depending on who has the most knowledge and experience in each situation. Therefore, participation is sharing of knowledge as defined by Dayle and Schively Slotterback (2009). In the project of El-Heiz, if we have considered ourselves the sole experts in the process, there would not have been this mutual learning in which we learned about the local ways of dates production and the local needs in a building design, and the locals learned about hygienic considerations for their dates, ways to increase their production, and constructing building foundations. This rotating role of the expert enabled us to maintain the ancient local ways of dates production with its health benefits due to roasting instead of dates' fumigation. In the pilot project, the locals were not just following the rules (such as covering palm trees with plastic bags or washing their hands before working on the dates), but they understood the advantages of what they were doing, and as some of them mentioned in the interviews, they started teaching what they learned to other farmers, which is a sustainability aspect in itself. Moreover, this rotation of the role of the expert made the participation process a real engagement one in which the locals had power as well as the professionals. This was an important factor for the sustainability of the project, because if the building was not designed through a process that integrated and respected the locals' traditions,

they may not develop ownership and hence may not sustain the project in the future. What the people were experts at along with their local traditions affected the priorities of the professional team working on the project. This is why the interior of the building was prioritized over the exterior, and why focusing on social issues like women employment in the pack-house came before implementing the hygienic standards in the design. The architect's priorities changed according to the context and its forces.

Even though the locals as my clients did not require specific drawings or visuals, nevertheless visualization of the design proved to be of extreme significance in the process. Through a normal conversation with the locals, they only set basic needs, but when integrating a 3D model and a plan of the pack-house in the discussion, they started giving detailed requirements such as reducing the number of connecting doors to maximize work counters and having more openings in specific rooms.

9.2. Sustainability Potentials of the Project

The dates pack-house has the potential of future expansion, that will enable more farmers to process their dates which will increase the revenues of the pack-house and will also lead to more workers being employed. Yet, in order to fully address the future sustainability of the project, its risks have to be identified.

The first risk lies in the possible problems that can hinder the licensing of the pack-house, which is essential for selling the dates. There are still uncertainties regarding the work division between men and women. If some activities are to happen by the women outside the pack-house, this may require building an external unit nearby the houses where women can work in since working at homes may not be hygienically acceptable. Such a new unit will inevitably have an impact on the project economics. If women will only do the initial rounds of sorting, they can work at homes. There is also the possibility of having separate working hours for women in the pack-house, which is pending the acceptance of the community. However, having women working in the pack-house separately lowers the workforce, unless it is at times when men are harvesting. This uncertainty of the operations and task divisions along with any other obstacle the project might face can hinder the licensing process upon which selling is dependent.

Another important risk to assess is related to the sustainable management of the pack-house. Selling produced dates is done by the investors, whose time dedication to the project may vary in different stages of their lives. The distribution of the dates is what guarantees the sustainability of the project, since this is the expertise the locals lack. For the project to have operational sustainability, the locals have to practice being their own leaders. So that years from now, when Batran and Tina are no longer leading the project, the locals have the capability of keeping it going on their own. The locals already have the know-how in terms of the dates production process, yet they lack the direct connectivity to the market. The step of selling the packed dates to supermarkets should include representatives from the locals with the investors. This was clearly one of the main incentives for the locals to partner with Tina and Batran, for they were not only bringing the funding for the building, but more importantly they brought the marketing knowledge that could transform the local trade from one dependent on traders to one that reaches the end user directly.

The fact that the local people are not risk takers in the process is another risk in itself. The plan is that the investors buy the dates from the farmers, then the local workers work on producing the dates with wages, then when the dates are sold the farmers and workers get their percentages of the profits. According to the investors, the reason why farmers are paid in the beginning is to ensure they have their fixed income similar to selling to traders, while being able to process their dates and sell them in the market for more income, without exposing them to the risk of losing. While having a profit share boosts the sense of ownership and motivates the locals. Not sharing any risks might do the opposite. It also leaves the question of whether people will do this on their own and process their dates when the investors are no longer paying the farmers in the beginning of the process unanswerable. This puts the sustainability of the project at risk, because whether people in the future will choose to take the risk and process their dates to sell them at higher prices or not is questionable.

The project is also prone to the risk of scaling up. The stakeholders of the project are all new to the market of dates. The locals are experts in dates processing, but they do not know about distribution systems nor the market in Cairo. The investors are academicians who are considered new to the market as well. While the pilot project showed positive results, selling in large quantities will definitely be challenging.

9.3. The Complexities of Implementing Sustainability in the Local Context

This experience of the dates pack-house project shows how in real life projects, we do not have that level of control over everything; it is not as simple as it may be portrayed in the academic perspective. Designing a project that theoretically fulfils being environmentally, economically, and socially sustainable, does not ensure its long term overall sustainability. We have to look at the bigger picture of the sustainability question because in practice, the sum of the parts does not add to the whole, and satisfying each category's requirements does not equate to overall sustainability. As Giovannoni & Fabietti explained, while sustainability means balancing between the environmental, social, and economic aspects, their co-existence result in complexities and require challenging trade-offs (Giovannoni & Fabietti, 2013).

Sustainability cannot be brought down to three intertwining pillars only. The relationship between the pillars is multi-layered and complex. Since a sustainable project has to stand the test of time, the time factor carries with it potential risks that may break a project that is environmentally, socially and economically sustainable. What is theoretically sustainable does not mean it practically is. Practically, there should be a projection of time with the risk it carries as a dimension in the equation. Time throws certain risks that are essential to be studied, and that cannot be classified the way sustainability was classified to environmental, economic, and social, but are dependent on each project and its case. In some situations, taking a decision that is not the best sustainable option under one of the pillars, can add up to the overall sustainability of the project. For example, in the case of selecting the building material of the pack-house, initially natural rocks were chosen for better environmental sustainability. However, the decision was diverted to white limestone bricks because bricks would not require massive amounts of cement to add the tiles finish required in the interior for licensing, they are more affordable, local young workers currently build with white limestone bricks so they would be building the project themselves.

This is where participation comes in; hands on experience in a project helps in building decisions that are not only theoretically sustainable, but practically as well. Participation also helps to explore the potential risks to prepare the project to face them while being sustainable.

9.4. Link between participation and sustainable development

A project that is sustainably designed theoretically, does not mean it will be practically sustainable. The factor of reality loosens the facts we know from academics. Designing through participation enables us to put the risks in consideration, which vary from one project to another, and can never be understood without being immersed in the process and understanding the people, place, and time. It was through participation that more factors came into the decision making process for a sustainable project. There were several incidents that proved that participation of the locals in the design process is an important factor for the sustainability of the pack-house. Understanding the traditions of the locals and that women can only work at home was very important, because otherwise we would have designed a larger space to take both men and women, which is something that the locals will never accept. Another thing was learning about the dates production process in order to design a building that they can actually use for its intended function. Throughout discussion, we also knew that we have to find an alternative to building an underground cooling room since the military will not allow it in this area, and the investors built a fridge instead. These were all important information that if we have missed, would have hindered the sustainability of the project. Understanding the context from the locals helps outside professionals to design sustainable projects. "Resident-driven" projects, are more likely to succeed, because it involves the knowledge of the users who know the most about their environment (Sanoff, 2000).

9.5. Final Remarks

In conclusion, while academic categorizing of sustainability helps set a framework to address designing a sustainable project, it is important to understand that in reality, these pillars will collide, not only with themselves, but with other factors that come into the equation. This makes the decision making process more complex, especially that in reality we do not have the level of control we think we might have. It is only through being part of a project and having a hands-on experience that one can absorb reality and fully understand the complexity of sustainability. When working on a sustainable project, it is false to assume that being professionals makes us the experts. We do not know better than the locals we are designing for, but we know differently. This is why a participatory approach can be taken in which the role of the expert rotates,

knowledge is shared, and the hidden risks of the project across time can be identified and prepared for, in order for the project to be a real sustainable one that withstands the test of time.

10. Limitations and Recommendation

Being part of the participatory process, my opinion must have been subjective in some situations. Documenting my and everyone else's opinion throughout the process sets the picture clear and prevents creating a biased image. As a recommendation for this research, it would be useful to analyze the environmental, social, and economic sustainability of the dates pack-house project when it is in operation. Looking into whether people will make changes to the building when it is in operation or not, and what will be reached from the potential sustainability aspects can be part of future studies. A general recommendation to architects and social developers is to consider the times and means of communication with the users. Understanding the users' needs early on in the design process is part of creating a sustainable building that people will still use in the future. As for the means of communication, participation in which participants input is as powerful as professionals is what results in valuable sharing of knowledge as well as buildings that really respond to people's needs and again, helps in sustaining the buildings. When designing a community based commercial facility, it is important to understand the way the locals make their own products and understand that they are the experts in it. Also, the time factor has to be considered with the three pillars of sustainability, because a project cannot be sustainable without analyzing the risks associated with it, that might not theoretically fall under any of the pillars but are risks that emerge from the context of each project.

11. Bibliography

Al-Hajeri, N. A. (2013, August). Green Building and Energy Saving. In *Proceedings of World Academy of Science, Engineering and Technology* (No. 80, p. 348). World Academy of Science, Engineering and Technology (WASET).

Arnstein, S. R. (1969). A ladder of citizen participation. *Journal of the American Institute of planners*, 35(4), 216-224.

Barcellini, F., Prost, L., & Cerf, M. (2015). Designers' and users' roles in participatory design: What is actually co-designed by participants?. *Applied Ergonomics*, 50, 31-40.

Baumgärtner, S., & Quaas, M. (2010). What is sustainability economics?. *Ecological Economics*, 69(3), 445-450.

Cobb, J. B. J. (1998). Notes from 'Sustainability and the Liberal Arts' Conference'. In *Sustainability and the Liberal Arts Conference*.

De Janvry, A., and E. Sadoulet. 2005. Achieving Success in Rural Development: Toward Implementation of an Integral Approach. *Agricultural Economics* 32 (1): 75-89.

Deyle, R., & Schively Slotterback, C. (2009). Group learning in participatory planning processes: An exploratory quasiexperimental analysis of local mitigation planning in Florida. *Journal of planning education and research*, 29(1), 23-38.

Freire, P. (1996). *Pedagogy of the oppressed* (revised). New York: Continuum.

Gray, J and Densten, I (1998) Integrating quantitative and qualitative analysis using latent and manifest variables *Quality & Quantity* Vol 32 pp 419e431

Gibson, T. (1988). *Planning for real: Users' guide*. Telford, UK: Neighborhood Initiatives Foundation.

Giovannoni, E., & Fabietti, G. (2013). What is sustainability? A review of the concept and its applications. In *Integrated reporting* (pp. 21-40). Springer, Cham.

Jones, P. B., Petrescu, D., & Till, J. (Eds.). (2013). *Architecture and participation*. Routledge.

Katoppo, M. L., & Sudradjat, I. (2015). Combining Participatory Action Research (PAR) and Design Thinking (DT) as an alternative research method in architecture. *Procedia-Social and Behavioral Sciences*, 184, 118-125.

Kent, G. (1981). Community-based Planning: A Better Approach to Development. *National Development, Middle East, Africa, Asia, June/July*.

Luck, R., & McDonnell, J. (2006). Architect and user interaction: the spoken representation of form and functional meaning in early design conversations. *Design Studies*, 27(2), 141-166.

McKenzie, S. (2004). Social sustainability: towards some definitions.

Morris, E.W. (1996). Community in Theory and Practice: A Framework for Intellectual Renewal, *Journal of Planning Literature*, Vol. 11, pp. 127-150.

Mubita, A., Libati, M., & Mulonda, M. (2017). The Importance and Limitations of Participation in Development Projects and Programmes. *European Scientific Journal, ESJ*, 13(5), 238.

Negroponte, N. (1975). *Soft architecture machines*. Cambridge, MA: MIT press. p 99

Oakley, P. (1991) *Projects with People: The Practice of Participation in Rural Development*, Geneva, ILO.

Perez, A.C. (1999) "Participation in development: evolution of a philosophy", In: Meera, K.S., Kambou, S.D. and Monahan, B. (eds.) *Embracing Participation in Development: Worldwide experience from CARE's Reproductive Health Programmes with a step-by-step field guide to participatory tools*

Riad, M. (1996). The date palm sector in Egypt. *CIHEAM-options Mediterraneennes*, 28, 45-53.

Sanoff, H. (2000). Community participation methods in design and planning. John Wiley & Sons.

Sanoff, H. (2008). Multiple views of participatory design. *International Journal of Architectural Research: ArchNet-IJAR*, 2(1), 57-69.

Schon, D A (1983) The reflective practitioner: how professionals think in action Temple Smith, London

Trienekens. J. H. (2011). Agricultural value chains in developing countries a framework for analysis. *International food and agribusiness management review*. 14(1030-2016-82778). 51.

Siu, K. W. M., & Xiao, J. X. (2017). Public facility design for sustainability: Participatory action research on household recycling in Hong Kong. *Action Research*, 1476750317698027.