Casa Peota: A Housing Strategy to Increase Homeownership in Venice

An Interactive Qualifying Project Report Submitted to the Faculty of
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requirements for the Degree of Bachelor of Science by:

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Abstract

Affordable housing in Venice, Italy is in short supply due to the abundance of short-term tourist rentals and the low wages available in Venice. Casa Peota is a conceptual startup previously developed in 2017 by SerenDPT. The goal of the startup is to leverage the higher earnings from tourist rentals to produce opportunities for affordable homeownership for residents. This project acted as an application of the Casa Peota concept to determine its viability with respect to buildings currently for sale in Venice, including their necessary renovations and thorough financial analyses of the economic feasibility of the concept. We anticipate that SerenDPT will use the results to further develop Casa Peota as an operational startup.

Executive Summary

Over the past 70 years, the population of residents in Venice has declined significantly. One of the main factors has been the inability of Venetians to afford to rent or buy a home, causing them to leave and find another place to live. Venice's growing tourism industry has compounded the difficulties due to its impacts on both the job and the housing markets.

While wages remained stagnant, the cost of long-term rentals (LTRs) has increased over the years. Currently, the monthly rent for the average-sized home in Venice (~80 square meters), is around €1,200 while the average monthly income for an individual sits at €1,500. Therefore, the average rent of €1,200 represents 80 percent of the average income, making LTRs largely unaffordable for people in Venice.

Moreover, due to the recent boom in tourist short-term rentals (STRs), Venetian residents have to cope with fewer and more expensive housing options. Rentals are becoming more scarce, as evidenced by the online platform Immobiliare.it, where in December 2023 one could find only 143 apartments for rent while there are ten times more units for sale (1,765).

Since the monthly rent for an 80 sq.m apartment in Venice would cost about the same as a monthly mortgage payment for the same size house, and given that there are more homes for sale than for rent, this project explored ways to make **homeownership** more approachable for Venetians, by revisiting a housing concept called *Casa Peota,* first developed by SerenDPT and studied by a WPI team in 2017.

Casa Peota aims to leverage the higher earnings from short-term rentals to subsidize affordable homeownership in Venice through a rent-to-buy model that eliminates the 20% 'down payment' which represents a major hurdle for young people buying their first home.

Though the idea was conceptualized back in 2017, SerenDPT is revisiting it in 2023 due to the recent increase in WPI students at the Venice Project Center (VPC). Before, only 24 WPI students came to Venice each year, for a 2-month period (term). Starting in 2024, there will be 65+ WPI students over the course of three two-month terms. Housing all VPC students currently costs about €250,000 each year because the accommodations are booked through normal STR hosts.

Our project explores how to 'invest' the yearly WPI housing funds into Casa Peota, to stabilize the cost for WPI students while creating a virtuous cycle that will gradually make homeownership available to young Venetian residents and couples. By filling 'empty days' with

medium and short-term rentals to temporary visitors, like other international students, remote workers, and tourists, Casa Peota can generate enough revenue to begin moving from a concept to a company.

Figure A (below) illustrates how Casa Peota plans to generate income through the housing of WPI students as well as STRs during the vacant months. With the purchase of two initial buildings, one building can house a permanent Venetian resident through a rent-to-buy model while filling the other units with STRs to continue generating revenue. After enough money is saved, Casa Peota can then buy, renovate, and sell units of future buildings to Venetians through the rent-to-buy model, allowing them to bypass the large initial down payment.
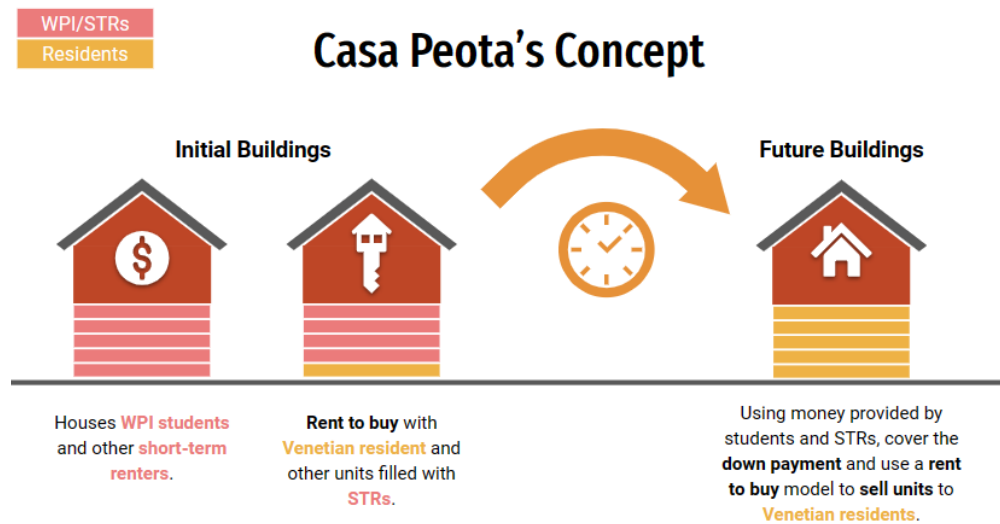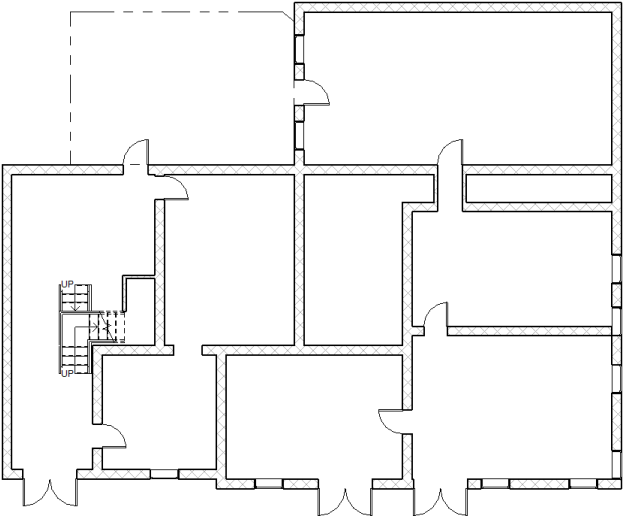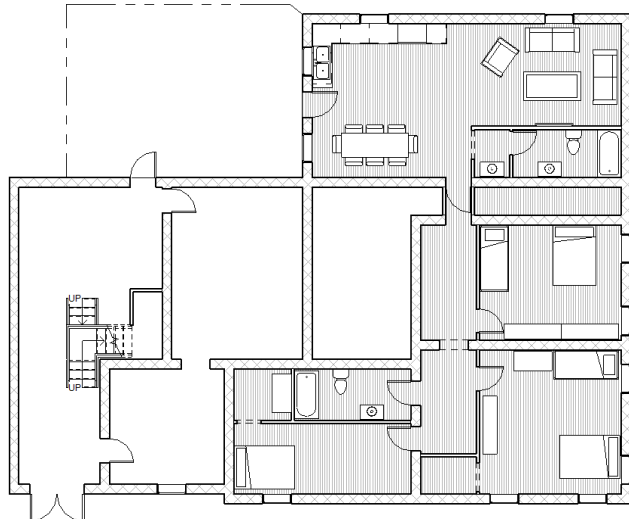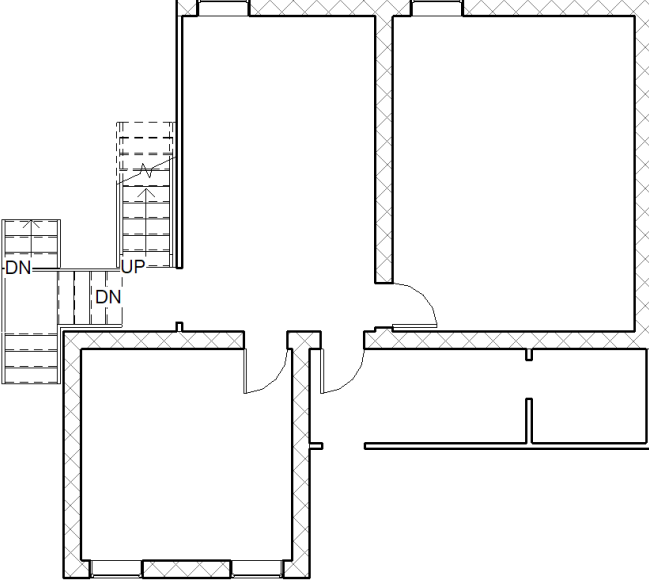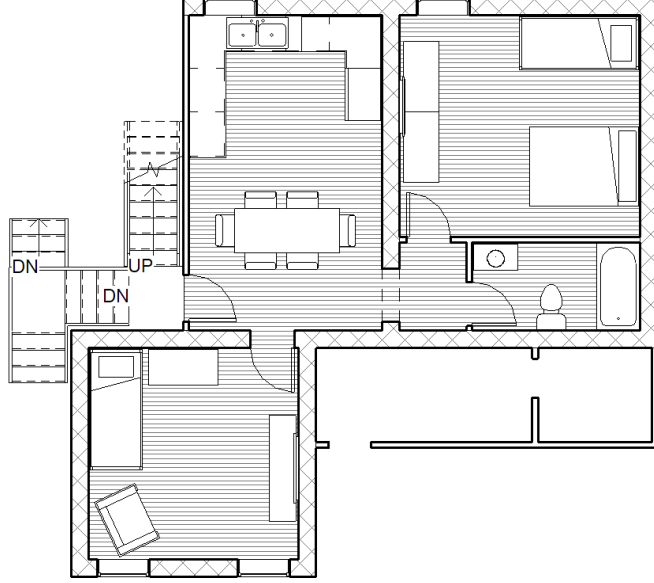

Figure A *Breakdown of Casa Peota's Concept*

Using this model, our team's mission was to apply the Casa Peota concept to actual large buildings currently on the Venice market, designing possible renovations that would create multiple independent units, and analyzing the overall financials to determine the viability of the operation.

Using Immobiliare.it we identified and visited five independent large apartment blocks, collecting measurements and taking pictures of the interiors and exteriors of each house. With the help of a local architect (Piero Toffolo), we **selected two** of the five buildings to conduct an in-depth architectural and financial analysis. Applying local Venetian building codes, we developed detailed CAD plans to maximize the number of units in each building.

Table A *Sample of Madonna House Renovation Plans*

	Original Floor Plan	Reconfigured Floor Plan
Ground Floor		
Mezzanine Floor		

The two houses we considered, Madonna House and L'Arzere House, will provide 40 total beds, 24 of which–all in the Madonna House–will be allocated to WPI students when the VPC is operating in the months of November-December, March-April and May-June. One unit in the L'Arzere house will be immediately made available to a local resident/couple with a rent-to-buy approach, while the rest of the L'Arzere units would be rented to temporary visitors for medium (preferable) or short stays. The 24 beds in the Madonna House will also be rented to

temporary visitors from mid-June to mid-October and between Christmas and Carnival, when no WPI students are in Venice.

Assuming a 30-year mortgage on both the Madonna House and the L'Arzere House, we found that to start the process of buying and renovating the homes, Casa Peota would need a total of about **€4.5 million**. Because banks typically do not lend the full price of a house, Casa Peota will also need another source of funding, from private investors, to cover the remainder of these upfront costs.

Taking into account all of the costs and revenues, Casa Peota could generate around €123,000 in profits every year. This number varies yearly due to the taxes not being uniform every year. Each cost and revenue source occurred at different times of the year, so we organized the spreadsheet to account for that as shown in Table E. This table also shows the first year of our spreadsheet which analyzed financials on a monthly basis and the theoretical profit of Casa Peota. This shows that following this model, Casa Peota will always have money saved up and will continue to save over time.

Table B *First Year Financials of the Casa Peota Model*

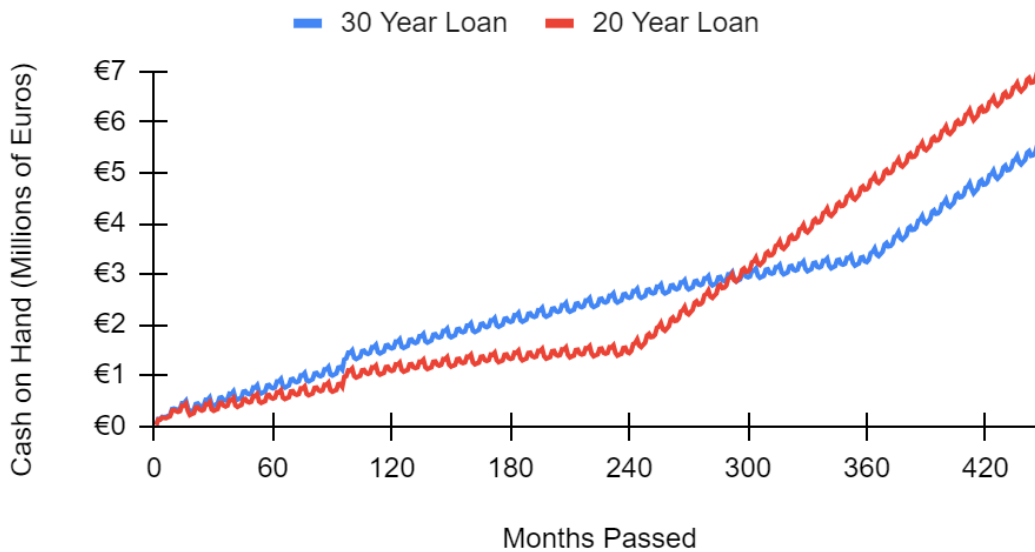| Month	Year	Revenue	Operational Costs	Interest	Principal	PI Payment	Taxes	Monthly Profit	Cash on Hand
Jan	1	€51,388	€7,717	€21,063	€17,270	€0	€0	€5,338	€5,338
Feb	1	€145,156	€7,717	€20,948	€17,385	€0	€0	€99,106	€104,444
Mar	1	€28,338	€5,717	€20,832	€17,501	€0	€0	-€15,712	€88,732
Apr	1	€75,418	€5,717	€20,715	€17,618	€0	€0	€31,368	€120,099
May	1	€16,813	€7,717	€20,598	€17,735	€0	€0	-€29,237	€90,862
Jun	1	€28,338	€10,717	€20,480	€17,853	€0	€0	-€20,712	€70,150
Jul	1	€51,388	€5,717	€20,361	€17,972	€0	€0	€7,338	€77,488
Aug	1	€51,388	€7,717	€20,241	€18,092	€0	€0	€5,338	€82,826
Sep	1	€145,156	€5,717	€20,120	€18,213	€0	€0	€101,106	€183,932
Oct	1	€39,863	€5,717	€19,999	€18,334	€0	€0	-€4,187	€179,744
Nov	1	€16,813	€5,717	€19,877	€18,456	€0	€0	-€27,237	€152,507
Dec	1	€34,101	€25,410	€19,753	€18,579	€135,405	€0	-€29,642	€122,865

Figure B *Comparison of Cash on Hand Over Time for 30 vs 20 Year Mortgage*

We also determined that in the apartment of the L'Arzere House that a Venetian would be purchasing using a rent-to-buy model, they would need to rent from Casa Peota for eight years and pay back 20 percent of the value of the apartment during that time. This time frame would allow them to pay back the 20 percent (€53,327) in affordable, monthly payments of €555.

Conclusions

The use of two buildings in the initial stages allows Casa Peota to deliver its mission of providing Venetians with affordable homeownership faster. The Madonna House will be able to host the future WPI students completing Interactive Qualifying Projects while the L'Arzere House will be able to accommodate the initial Venetian resident or couple, as well as three STR units. Through our research, we found that the WPI students' rent plays a critical role in the foundation of Casa Peota. Without the secured rent of over 60 WPI students visiting yearly, Casa Peota would not make enough yearly profit to support the buildings the startup looks to purchase. We found that the best loan length was 30 years, as it was less risky than a 20-year loan, which would have been paid off sooner but left Casa Peota with less cash on hand annually. The spreadsheet allows Casa Peota to visualize the projected cash flow from different mortgage parameters, allowing them to find which fits best for certain goals.

Recommendations

The next steps for those looking to further Casa Peota to take real form include finding an initial source of funding, as well as finding buildings for cheaper within the Venice housing market. Another scope of the project to explore would be the relationship between Casa Peota and the initial Venetian resident. While we considered them to utilize the rent-to-own approach on their unit within the L'Arzere House, we recommend looking into the financial components if they were utilizing the host-to-own model with the other units within the building. We also suggest considering the Venetian resident as a superintendent to the rest of the STRs and analyzing the financial model behind that. Among all of these scenarios, we recommend future groups to create a sample legal agreement between Casa Peota and the residents, ensuring that once they own the building they would not be able to reallocate it back as a STR. Finally, we suggest future teams working with Casa Peota to use our original spreadsheet and create a function to visualize the timing of selling units within the L'Arzere House to Venetians while the startup still makes a profit to go towards the future buildings in its model.

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Authorship

The following table illustrates the authorship and editorship of the report by section.

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Executive Summary	Keanna Bruce & Divya Kumar.	All
Acknowledgements	Divya Kumar.	All
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2.0 Background	All	All
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2.2 Rental Options in Venice's Market	Keanna Bruce.	All
2.3 Homeownership	Jeffrey Chan & Spencer Doran.	All
2.4 Exploring Alternative Housing	Felicia Link.	All
2.5 SerenDPT's Proposed Startup "Casa Peota"	Divya Kumar.	All
3.0 Methodology	All	All
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3.2 Develop a restoration plan for the most viable buildings.	Spencer Doran & Felicia Link.	All
3.3 Analyze the financials for the purchase, restoration, and rentals.	Divya Kumar.	All
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Appendix A: Interview questions for architects, real estate agents, and contractors	Felicia Link.	All
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Appendix E: Building Financial Data	Jeffrey Chan.	Jeffrey Chan.

Acknowledgements

1.0 Introduction

The historic city of Venice, Italy has attracted millions of tourists with its unique location, intriguing history, and gorgeous sights of its buildings and canals. However, as tourists continue to visit each year, there is a constant decline in the number of Venetian residents in the historic city that began in the early 1950s. Back then, Venice's population had around 175,000 residents, which was its historic peak. By 2023, the number had diminished to less than 50,000 (Comune di Venezia, 2022). Many point to the monopolizing effect of tourism in the Venice economy as the major factor forcing residents to leave the city (Ianniello and Canoves 2022, Bertocchi and Visentin 2019, Salerno and Russo 2022). The lack of job diversity in Venice has also contributed to the depopulation. A 2019 study by SmartDest showed that the majority of professions are tourist-related. The other factor in residents leaving Venice is the lack of available and affordable rentals. Venice's location in the lagoon limits the ability to add more buildings for residents, and its historical and architectural importance restricts the possibility of completely reconstructing any existing buildings. Therefore, the residential accommodation supply in the city is already limited, with little space remaining to place citizens looking to stay year-round due to the "substantial number of conversions from residential to tourist use" (Salerno and Russo, 2022, p. 2). The increasing scarcity and increasing prices (see Figure 1) of long-term rentals located in Venice escalate the difficulty for Venetians to reside in the city, and as a result, the population continues to decline.

Figure 1 *Average Rent Price Per Square Meter in Venice* (Immobiliare.it)

Some corporations like SerenDPT have been creating efforts to diversify the job market. Other corporations, as well as the Venetian government, have attempted to implement programs and other solutions to provide opportunities for local homeownership to combat the city's rapidly

declining population (Venice Population. Why Do so Many Venetians Escape Venice?, 2019). However, housing availability has become more limited even for workers, as only about 6,000 homes on the market remain affordable for low-income residents in the historic city (Ocio, 2020). Public housing exists as one approach to house more residents, but affordable long-term rental (LTR) housing is becoming more difficult to find as the short-term rental (STR) housing market proceeds to "take over" with the number of tourists looking for short-term housing rapidly growing. With the number of LTR options dwindling, real estate platforms such as *Immobiliare* list more homes for sale than for rent. Purely based on the numbers of each available, it would be easier for Venetians to find residency through buying a house instead of renting. The biggest problem keeping Venetians from buying homes is the high costs. The main challenge serving as an obstacle for a Venetian to afford a home is paying the upfront down payment (which is about 20 percent of the property price) that a bank would not cover (Italian Payroll – Italian Payroll, n.d., Case in Vendita - Immobiliare.It, n.d.).

Casa Peota is a concept developed by SerenDPT to provide financial support for Venetians looking to buy a home and to increase resident homeownership. Using a *host-to-own* model, Casa Peota will purchase buildings in the city and use rentals to pay them off. Once paid off, any profit from rentals will go towards purchasing new buildings where Venetians can use a *rent-to-own* model to circumvent the upfront down payment and better afford owning the home. Our project worked under SerenDPT to further develop the startup concept by devising a model utilizing tourist rentals and WPI Venice IQP student stays to generate funds used to purchase and restore buildings for sale to be rented out to Venetians. Our steps in furthering the startup in our project included searching for houses for sale, creating potential renovations to maximize occupancy, and analyzing the financial stability of purchasing and paying off these buildings. We intend for SerenDPT to use these findings to support the startup of Casa Peota.

In this report, we set the background of the Venice housing crisis and the current rental options in Venice's housing market, then explore the topics of homeownership and potential alternative housing methods. Lastly we describe in more depth Casa Peota's existing startup model. We then discuss the methods used to complete our objectives, the overall results, and the deliverables we produced for each step. Finally, we analyze the results to conclude the feasibility of the Casa Peota model and its potential future impact on Venice and the rate of resident homeownership.

2.0 Background

Venice has been facing a housing crisis for years, driving residents out of the historic city to live in other locations they can afford and seek a wider variety of job opportunities. Tourism is a main contributor to the housing crisis as affordable long-term rental housing becomes increasingly difficult to find with the increase of tourist-centered rentals. To understand the general real estate market and the difficulties of Venice's housing market, we researched the process behind buying a home and homeownership. The complex process includes different financial components such as placing down payments, paying off mortgage loans, and building equity so that the property becomes worth the investment. For individuals and families generating low incomes, especially in Venice, committing to a down payment and investing in a property is risky and not feasible. There are companies in the U.S. that have financial models to aid in removing down payments for those who cannot afford them. There are also alternative housing strategies to reduce the cost of living. The Casa Peota concept considers these problems and potential solutions to develop a startup model that aids to diminish Venice's persistent housing crisis.

2.1 Venice is Facing a Residential Housing Crisis

Only about 40,000 dwellings remain in Venice, a quarter of which are potentially available for both long and short-term rent in the competitive housing market in Venice. These 10,000 rentable apartments are contested between locals, students, and tourists, with the latter being the most preferable renter of choice from the owners' perspective (Smartdest, n.d.). The rise in STRs in Venice has drastically reduced the number of apartments available as affordable LTRs for local residents. Owners prefer renting to tourists short-term rather than renting to a local long-term because it is much more profitable and does not carry the risk of the inability to evict tenants in arrears (Campaign for a Living Venice, 2018). As a consequence, housing in Venice has become more expensive for the average Venetian, and the typical salaries in the city have not attainably aligned with the rising cost of living. Therefore, challenges persist for locals to stay in the city.

2.1.1 Tourism has an Effect on Housing Availability in Venice

The mass tourism Venice experiences every year has had a major effect on the city's housing market. The rapid and recent increase in overnight stays and STRs through platforms like Airbnb and Vrbo, along with the decrease of inhabitants in the city, means more houses are being used as STRs only. As Ianniello and Canoves (2022, p. 179) discuss, "growth in accommodations for tourism purposes is the main displacement force since it actively removes area from the market to allocate it to tourists." The number of bed spaces for short-term visitors was recorded at 77,180 in 2020 before the global COVID-19 pandemic hit, with 49,295 located in the historic city. This is about 61 percent of the accommodation supply in Venice (Salerno & Russo, 2022).

As Venetians are forced to compete for rentals with tourists, they must afford the raised prices associated with short-term stays. Residents must pay rental prices that are aimed at tourists and overnight accommodations, which are higher so the owners can profit off visitors in the city. According to the *Inside Airbnb* website, up to 64% of Airbnb hosts in Venice have more than one rental listing, suggesting they are using most properties for profit and not their own living space. Around 80% of the listings in Venice are entire homes and apartments, compared to single room rentals, taking even more units away from Venetians. (*Venice*, n.d.*)* The saturation of short-term rentals aimed toward tourist-stays in the city largely diminishes the number of available options for Venetians looking to rent, especially ones looking to rent at lower prices.

2.1.2 Resident Wages Can Not Afford Rental Prices

Because tourism is Venice's largest source of income, many residents have low-income service jobs to fit the needs of high tourist rates. A 2021 SmartDest report on Venice stated that "commerce and hospitality dominate the job market in the [historic city]," and the way an "outward migration of residents from Venice proper in pursuit of jobs in non-hospitality" has been occurring (Smartdest 2021). Waiters, water taxis, concierges, tour guides, and souvenir shopkeepers make up most of the occupations found in the city.

The minimum salary for a typical worker in Venice is €18,120 a year, which is €1,510 per month (Italian Payroll – Italian Payroll, n.d.). For a household of two people, this equates to a combined annual salary of €36,240 and a monthly salary of €3,020. With the current average rent price per square meter in Venice at €14.82, and the average home size being 81 square meters

(Wilson, 2022), the rent price per month for an average sized home would be €1,200.42 (Immobiliare, 2023). Compared to the typical working minimum salary, renting in Venice is barely affordable. Even with the double income of a couple, it is still difficult to afford.

2.2 Rental Options in Venice's Market

Rental options in the Venetian housing market are still available, although they are becoming scarce and their prices remain high due to tourism. The options include short-term rental, medium-term rental (MTR), and long-term rental models. This section discusses the differences between them and the ways that local residents could benefit from the LTR approach more than the STR and MTR approach.

2.2.1 Short- and Medium-Term Rental Models

Short-term and medium-term rentals are aimed toward vacation tourists, visitors, and business travelers and typically have only a bed and bathroom. Common examples of STR models include hotels and bed and breakfasts (B&B), where B&Bs must also offer breakfast to visitors during their stay. Aside from hotels and B&Bs, online platforms exist to book STRs which include websites such as Airbnb, Vrbo, and FlipKey. On these platforms, people are able to list their homes to be rented out for a short period of time (no more than 30 days) for prospective tourists to see when they are planning their upcoming visit (Sampaoli & Pellacchia Law Firm, 2022). They have the ability to choose from a wide range of properties and price points to plan an effective itinerary for their visit. The property owner does not typically stay at the housing while the short-term renters are staying there (Barron et al., 2020).

One example of a large event that brings in numerous visitors to Venice is La Biennale Di Venezia. La Biennale is a cultural institution that holds events celebrating visual and performing arts, including architecture, cinema, dance, music, and theater (La Biennale Di Venezia, 2022). Biennale Arte 2022, one of the recent exhibitions held, had the largest attendance in history with over 800,000 tickets sold. Fifty-nine percent of the visitors were foreign, and the rest came from Italy. Because Biennale typically takes place from April to November, the chance of the majority of foreign visitors staying in STR and MTR models such as Airbnb is high.

2.2.2 Long-Term Rental Models

Long-term rentals are aimed toward local residents and are offered by local landlords. LTR properties include a bed, bathroom, kitchen, and living area, as a one- or two-resident apartment model would typically have (Barron et al., 2020).

The prominence of STR options available in popular tourist areas causes LTR properties to be repurposed as a STR as the income from frequent tourists appeals more to the property owner. This leads to LTR prices increasing and STR prices decreasing (Horn and Merante, 2017). Therefore, STRs remain more appealing and easy to rent out, and LTRs remain more difficult to access for people seeking affordable housing to rent and live in. More risk regarding the legal environment is involved because "long-term tenants are typically afforded rights and protections that are not available to short-term visitors" (Barron et al., 2020, p. 9).

Even though it is easy for LTRs to be turned into STRs, a property owner may not choose to reallocate their property's purpose. One main common reason is that the owner may continue to live in their home throughout the time they are renting it out in contrast to STRs. Another reason is that disadvantages exist with keeping a large number of STR properties in major tourist areas (Barron et al., 2020). For example, the frequent movement of short-term renters may cause inconveniences for neighbors nearby, "thus reflecting poorly on the host and reducing his social capital in the community" (Barron et al., 2020, p. 10). Additionally, though STR income may be higher, the income from LTRs would be steadier and more convenient for the property owner to handle.

For Venetians, both STR and LTR are common ways of paying for residency in the city. Since both are becoming less affordable with rising rent prices, it would make sense for those to look into buying instead of renting and owning their house.

2.3 Homeownership

In contrast to renting their home from another individual, homeownership is when a person owns the home they live in. While renting, residents are in a contracted agreement between them and the owner (or landlord) that determines the amount of money they owe each month, and the owner has the ability to raise the rental price or sell the property. The owner is expected to handle repairs and cover any expenses. For a resident homeowner, they themselves are responsible for all maintenance and repair costs. Owning a home can help build equity, and

depending on the trend of housing prices, residents can make or lose money. Due to the high price of homes, it is common for residents to need financial aid to afford homeownership. A popular way of purchasing a home is acquiring a mortgage.

2.3.1 Homeownership is Becoming Less Affordable

When purchasing a new home through a mortgage, a buyer takes out a loan with a bank or a mortgage broker. The amount loaned to the buyer needs to be paid back with interest monthly over a period of time which is typically 15 or 30 years. One's credit score influences the interest rate, but the average rate in America in 2023 is 7.12% (*MORTGAGE30US*, 2023). The amount that the bank will not cover is called the down payment, which must be paid upfront and is often 20% of the total price as any less requires the buyer to pay mortgage insurance (Crace, n.d.).

The average monthly payment required to own a home in the US has increased dramatically since 1984 while the median monthly income has stayed relatively stagnant, as seen in Figure 1. This has resulted in mortgage payments costing the average person nearly half of their monthly salary in 2022. From Figure 2, the cost of the average down payment has also gone up drastically, from 34% to 144% of the average annual salary since 1984 (U.S. Census Bureau, 2023). This shows that in America, the average house is less attainable for the average person in 2023. This higher relative cost has significantly increased the difficulty of purchasing a home.

Figure 2 *Monthly Income vs Mortgage Payment Over Time*

Note. The income data is taken from *Real Median Household Income in the United States*, by U.S Census Bureau, https://fred.stlouisfed.org/series/MEHOINUSA672N. The mortgage data is taken from Average Sales Price of Houses Sold for the United States, by U.S. Census Bureau, https://fred.stlouisfed.org/series/ASPUS. *Copywritten material used with permission.*
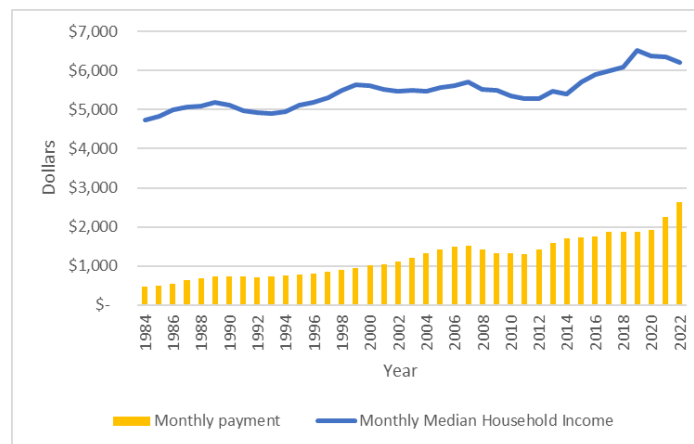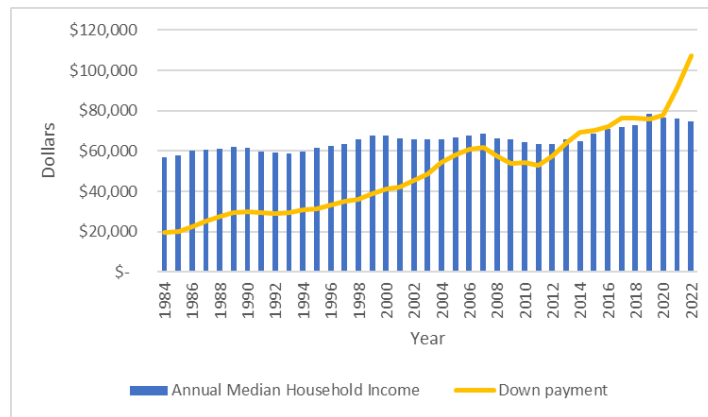
Figure 3 *Annual Income vs Down Payment Over Time*

Note. The income data is taken from *Real Median Household Income in the United States*, by U.S Census Bureau, https://fred.stlouisfed.org/series/MEHOINUSA672N. The mortgage data is taken from Average Sales Price of Houses Sold for the United States, by U.S. Census Bureau, https://fred.stlouisfed.org/series/ASPUS. *Copywritten material used with permission.*

In Venice, due to the large number of tourist rentals there are actually more houses on the market for sale (1,765) than there are for rent (143) (Immobiliare, 2023). Because of this, it would be easier for a Venetian to find a house to buy, yet the high down payment prevents most from obtaining homeownership. The average size home of 81 square meters at the average sale price of €3,047 per square meter, the total cost of an average sized home would come to €246,807 (Immobiliare, 2023). Using the typical 20% for the upfront cost, an average down payment would be €49,361. With the annual minimum salary for a Venetian couple being €36,240, the household would be spending over a full year of their income on the upfront cost of a mortgage. Venetian residents are in need of alternative options to aid in affording or circumnavigating the down payment to become homeowners.

2.3.2 There Are Existing Models to Aid in Affording Homeownership

There are currently existing companies located in the U.S. aiding residents in affording homeownership with rent-to-own and host-to-own models. Divvy Homes and Loftium are two of the most notable organizations that employ these models.

Divvy Homes covers the cost of the down payment (taxes, insurance, and closing costs included) on a house for pre-qualified customers, and for the next three years the customers rent the home from them. From the monthly rent, Divvy allocates a portion to pay off the down payment at the end of the three years. The benefit of this rent-to-own model is that residents are

not required to pay the costly down payment upfront and instead only place down 1-2% that is placed in their savings. They also have the option to move out early if plans change, and they get to keep any savings made but do have to pay a relisting fee (Rent-To-Own Your Dream Home, Divvy, n.d.).

Loftium also covers all upfront fees when purchasing a house, with the residents only providing 1% of the price to be put aside for savings. The difference from Divvy is that residents are required to rent their space out to guests to make income that goes towards making the down payment in the future. Loftium will set up the guest space and provide its own app for hosting, and residents keep 60% of guest income. Once residents save up enough they can purchase the home from Loftium at pre-fixed rates. The benefit of this host-to-own model is that Loftium takes the burden of the down payment and provides the residents the ability to make income through renting to guests which helps cover the mortgage costs. Once the residents pay off the down payment and own the home they are free to continue renting the guest space or use it themselves (Loftium, n.d.).

Both the rent-to-own and host-to-own models eliminate the obstacle of the mortgage down payment. With host-to-own, the residents have accommodating units for temporary guests, but most single-family homes have limited rooms for this. Income from rentals can be maximized with entire multistory buildings that contain multiple units, where the additional income from multiple guest units helps the resident pay off the mortgage faster.

2.3.3 Utilities and Energy Efficiency

Another way to further decrease the cost of living for residents is to increase the energy efficiency of buildings. The time and costs it takes to plan and carry out renovations may seem overwhelming for decision makers, however, the "building sector is…the biggest single contributor to world energy consumption and greenhouse gas emissions," which makes solving this problem beneficial for both people and the environment (Allouhi et al., 2015, p. 118).

This process is often made even more complex since buildings and their environments involve "technical, technological, ecological, social, comfort, esthetic, and other aspects," (Asadi et al., 2014, p. 445). Having to consider all these facets may initially turn decision makers away from the idea of renovating. However, energy-efficient applications will lower the cost of utilities for residents as opposed to occupants who live "in an inefficient building," where they may be

forced to "lower temperatures, hot water consumption, lighting, cooking, and other appliances to lower their energy bills," (Torgal et al., 2017, p. 262). While the results may not immediately benefit renters, landlords will eventually need to spend less on maintaining their buildings and the utilities cost for residents will decrease as well. See Appendix B for specific examples of energy efficiency upgrades.

Outside of host-to-own, rent-to-buy, and energy efficient methods of making homeownership more affordable, there are alternative housing methods that explore how multiple units can coexist in a building and share the costs to lessen the financial burden on each occupant.

2.4 Exploring Alternative Housing

For this project, we define alternative housing as housing strategies that utilize community living in some way to cut down on overall costs. Community living is unique in that certain aspects of an accommodation are shared, rather than individual in typical homeownership. Alternative housing can be recognized by creative programming of space and the utilization of communal spaces and amenities. Housing alternatives to typical homeownership of single-family homes seek to increase homeownership by making it more affordable. In this section, we detail communal housing, co-op housing, and co-housing strategies.

2.4.1 Communal Housing

Communal housing is common practice for many young adults, most commonly seen with university students and recent graduates. Communal housing is when multiple people live within the same apartment unit or home, sharing all of their spaces except for their own individual rooms (Törnqvist, 2019). This housing form saves money for tenants by splitting up the cost to rent a large space between many people, giving each individual access to common spaces for lower amounts of money. An issue with communal housing, unlike other alternative forms of housing, is that it is built on living together alone. Communal housing seems to work best when the tenants are uninvolved with each other. While not for everyone, people who choose communal housing enjoy the privacy they get from it, as everyone in the unit typically keeps to themselves. This model enables autonomy in its residents, while also saving on funds (Törnqvist, 2019).

Though this model works for some, it does not contribute to the accessibility of homeownership. Rather, it is a great way to cut down on costs, but does not lead tenants directly towards the goal of owning their own home other than saving money with cheaper rent costs.

2.4.2 Co-op Housing

Co-op housing or housing cooperatives are a housing strategy that accommodates multiple tenants in a shared building. When an individual lives in a co-op, they buy shares in a corporation that owns the entire building. The number of shares a person buys is directly related to the size of the apartment they live in. With this model, the inhabitants do not own their own apartment, just their shares of the corporation, meaning all the inhabitants are equally responsible for expenses to maintain the property. This greatly increases tenant control in decisions that affect the whole building because they are all paying for their shares (Sørvoll, & Bengtsson, 2020). While this model is useful to lower the full price of a dwelling, especially the initial down payments as opposed to purchasing a home or a condo, the monthly payments tend to be higher. Co-op housing also cannot be financed by a typical mortgage. While there is the option to finance the payment of shares to larger payments up front, this option isn't typically chosen as the price is similar to that of a down payment.

Cooperatives are largely popular in high density cities, like New York City. In his article "'I Am Not Co-op!': The Struggle over Middle-Class Housing in 1970s New York," Benjamin Holtzam explained how at the time, middle class homeownership was rare, as the market was dominated by rentals which gave few opportunities for homeownership. At the time, landlords and major real estate associations argued that converting rentals into co-ops could bring success back to New York City's real estate market. One real estate agent, Rexford E. Tompkins argued that since the current market was unattainable, the introduction of co-ops would lower overall prices for prospective owners as well as increase sales (Holtzman, 2017).

At the time of the introduction of co-ops to the city, tenants rejected the idea because they preferred the safety of their rent-regulated units. Renters feared that they would not be able to afford to purchase their apartments and would be evicted, which made them react strongly against any plans for conversions. They also did not believe that co-ops would stabilize their neighborhoods as was advertised by landlords and real estate associations. "To conversion advocates, the link between homeownership and maintaining a vibrant middle class could not

have been clearer. "The only way New York will retain its middle class," another proponent proclaimed, "is to permit them to own a piece of it. People have given up on the city, but you don't give up when you have money in it" (Holtzman, 2017, p. 52). Some co-ops did eventually begin, and their owners began to advocate for the positive change it had made in their lives. Through the early 1980s, the opinion on homeownership in New York City greatly changed. The many conversions to cooperatives had a great effect on the real estate market, benefiting landlords, tenants, and real estate associations alike. The number of building plans for conversions greatly increased through the early 80s. Today, New York's market is still largely dominated by rentals, but a large number of co-ops remain (Sammartino, A. H, 2022).

While co-operative housing increases homeownership and lessens the number of rentals available in a given market, it does not completely eliminate the obstacle of a down payment, as the costs that would have fallen under a down payment get spread out across monthly payments, driving the monthly payments higher than typical rents. As Cooperatives are not rent controlled like the existing apartments, payments are subject to change by many factors such as repairs and other unforeseen circumstances which would normally be dealt with by a landlord or superintendent, which does not foster security as much as hoped.

2.4.3 Co-Housing

Co-Housing, like cooperatives, functions with multiple tenants and units living together in one building. Beck (2020) explains that tenants who decide to live in co-housing can either decide to own their portion of the building or rent from an investor who owns the space. Since the building is already owned, the downpayment is eliminated for tenants who choose to live there. The price of living is consistent as it is typically rent controlled, with the upkeep of common spaces the focus of expenses. The main difference being that co-housing takes advantage of what is called a 'common house.' The basic design of co-housing consists of multiple one- or two-bedroom units, and a common area. The common house is a large space that consists of amenities for all the tenants in the building. While an individual unit might have a small kitchenette and living room along with the bedroom and bathroom, the common house, open to all the tenants, could have a large and updated kitchen, dining area, living room, or even a gym. This common house can be used daily or reserved for large gatherings, housing more expensive equipment that might not be feasible to have in each unit. Co-housing strategies help

to lower the cost of living for tenants while catering to their needs for long-term stays, rather than short-term rentals (Beck, 2020).

Co-housing, unlike housing cooperatives, relies greatly on and fosters community between tenants. With the use of common spaces and shared resources, the tenants have a strong community. Because of the shared aspects of co-housing, it is a great model to use for many demographics. Co-housing buildings can be geared to students and young workers, families, and seniors, all by following the same model with edits to what type of units fill the building. In the United Kingdom, a co-housing community for senior women greatly increased the quality of life for the women. The co-housing community offered them the safety of having others around, community, and lower prices (Arrigoitia, & West, K., 2021).

By utilizing the alternative housing strategies above and maximizing occupancy, residents can further lower their share of costs. The Venetian startup Casa Peota explores the use of alternative housing as well the rent-to-own model to assist Venetians in circumnavigating the costly down payment.

2.5 SerenDPT's Proposed Startup "Casa Peota"

SerenDPT is a "Venetian Benefit Corporation with the mission of repopulating Venice through the support of startups that provide high quality jobs in the historic city" (*SerenDPT*, n.d.). Previously, the 2017 WPI project "Leveraging Tourist Rentals to Make Housing Affordable for Venetians: A Feasibility Study of Casa Peota and Fairbnb" had their team working under SerenDPT and created a conceptual framework for Casa Peota, a startup with the goal of lowering the costs of homeownership. Casa Peota's model had the startup purchasing and renovating buildings to be rented out to WPI students as well as tourists, while including a unit for a Venetian resident to rent at an affordable price. The profits from these rentals would be used to pay off the buildings and restorations. The Venetian residents would be able to save up for their own mortgage through the rent-to-buy model. Casa Peota would then be able to sell more of the units to Venetians as they pay off the building, and the continued income from student and tourist rentals would allow the startup to start the process on new buildings.

This 2023 project works under SerenDPT to further develop their model and establish previously conceived "Casa Peota" as a viable startup to make homeownership more affordable for residents in Venice. With WPI students now staying in Venice for three academic terms (a

total of 24 weeks of the year) versus the previous one, Casa Peota can utilize the large sum WPI pays for over 60 students' housing as well as the high profits of short-term renting to tourists to fund the purchase and renovation of buildings to be rented out then sold to Venetians. The Venetian residents will then follow the rent-to-buy model to finance monthly payments to pay off the down payment and eventually own the home. The first 20% of the price of their apartment will be paid for by them renting from Casa Peota over a set number of years. The remaining value of the apartment will be taken out as a loan by the Venetian once the 20% has been paid to Casa Peota. This ensures that they will not need the large down payment normally required to buy a home. The Casa Peota startup will also aid SerenDPT's goal of diversifying the Venice job market by providing opportunities for jobs within the startup, with positions overseeing the locating, remodeling, and renovating of more potential buildings, as well as working with the residents to maintain any contractual agreements.

3.0 Methodology

   The mission of this project was to implement Casa Peota's concept through selecting example buildings, creating renovations, and analyzing financials to determine the viability of the startup.

Our objectives were as follows:

1. Identify and visit suitable homes on the Venice market.
2. Develop a restoration plan for the most viable buildings.
3. Analyze the financials for the purchase, restoration, and rentals.

The project focused on houses for sale in Venice that could be purchased through sites such as Immobiliare.it; see Figure 3 for a map of for-sale properties across the city. From October to December of 2023, we visited and examined multiple houses with the potential to fit this program's needs.
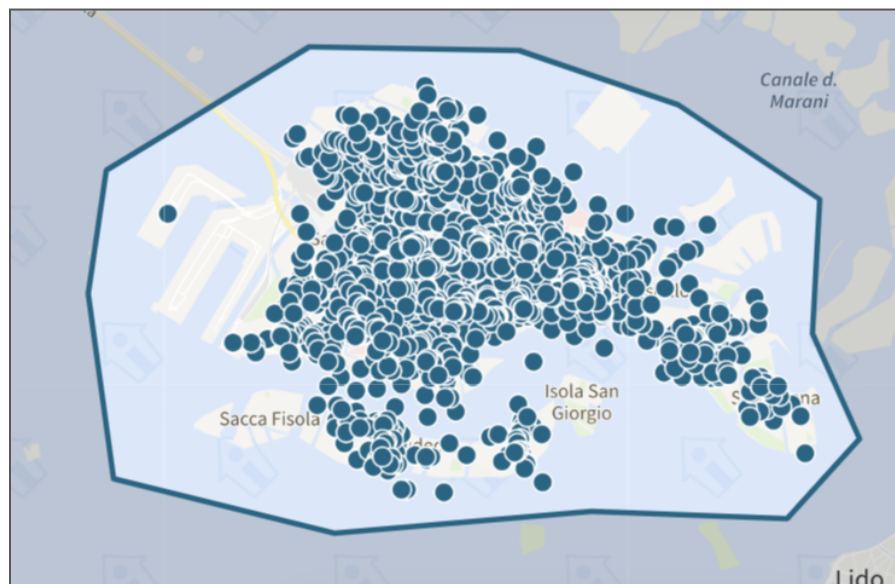

Figure 4 *Homes for Sale in Venice in October 2023* (Immobiliare.it)

The following sections describe the methods we followed to achieve each of the objectives listed above.

3.1 Identify and visit suitable homes on the Venice market.

Using the following parameters provided by Professor Carrera (see Table 1), we searched immobiliare.it for houses to visit. We worked with SerenDPT employee Aurora Del Sordo to select the houses and set up a scheduled tour with a local real estate agent.

Table 1 *Immobiliare.it Search Parameters Used*

Search Parameters Used in Immobiliare.it
For Sale
Independent House
300+ Square Meters
5+ Bedrooms

At the tours we were accompanied by local architect Piero Toffolo, members of SerenDPT, a local real estate agent, and the property owner. We dedicated members to taking pictures, videos, and measurements of each room using apps on our phones. We also had members taking notes on any significant factors in the houses' layout and architecture, as well as sketching up possible reconfigurations. The data from our visits as well as information on the listing's webpage (including the current floorplans, interactive videos and 3D models) were organized and stored in Google Drive folders. We composed a spreadsheet to list and compare information for each building we visited. The information included the number of floors, commercial and actual area, list price, and price per square meter. We used these to select the houses that would best meet the goal of fitting a WPI cohort and a Venetian as well as being low enough in price to make the yearly costs affordable to Casa Peota.

3.2 Develop a restoration plan for the most viable buildings.

Once the most viable buildings were selected using the toured house data, we started working on reconfigurations that maximized the number of units and number of occupants for them. We used the building modeling software Revit to recreate the existing floor plans. Meetings with Mr. Toffolo provided us with local Italian building codes, most notably the minimum size requirements for bedrooms with different capacities, as well as kitchens, bathrooms, and living rooms. We cross-referenced these values with sources like the

International Building Code (International Code Council, Inc, 2021) and Regolamento Edilizio (Comune di Venezia, 2019) Venice's local regulations.

With the minimum room size requirements in mind, we used Revit to create new floor plans for the selected buildings that maximize the number of units and total occupancy, with the goal of twenty-four beds for a typical WPI cohort and at least one separate unit for a Venetian individual, couple, or family. The units were made to include one or more bedrooms, a kitchen/kitchenette, and a bathroom. Multiple revisions on the plans were modeled in Revit, and Mr. Toffolo's own designs were consulted for inspiration. We selected final designs based on which provided the largest number of beds, and the renovated buildings were used for further financial analyses.

3.3 Analyze the financials for the purchase, renovation, and rentals.

Next, our team performed cost analyses on the houses selected and the restoration designs generated. We gathered information regarding all of the associated costs of buying a house and operating a business (Casa Peota) through discussions with Luca Giuman, the Chief Financial Officer of SerenDPT. We then created a spreadsheet with all of these various costs and the rental income broken down into a monthly and yearly basis. We explored different loan totals and mortgage rates to determine which would be affordable with the revenue made and which would be the most reasonable with the length it takes to pay off. We analyzed the feasibility of the purchases using the aggregation of revenue and costs, and produced a table and graph tracking the cash flow of Casa Peota over time to visualize and ensure affordability.

Once the financials were finalized, we created a dossier for each of the properties that included address and location, list price, commercial and actual area, pictures of the interior, floor plans before and after renovations, number of potential residents, unit sizes, rental cost per unit, and estimated mortgage renovation costs. We created these dossiers to condense the most relevant information found and determined on each property so that they could later be used to present the financial potential of Casa Peota's proposed plan to banks, investors, or other sources of funding.

4.0 Results and Analysis

The following section discusses the results of our methods and work done to accomplish this project's mission while in Venice. Each subsection focuses on one objective and includes the research findings, meeting outcomes, data collected, calculations made, models created, and accompanying deliverables for each. First, we share the data gathered during the tours of selected buildings for sale in Venice and the analyses used to determine the most viable buildings. Next, we share the reconfigured floor plans made for the chosen properties. Then, we share the financial analyses of the costs of purchasing and renovating the buildings as well as the estimated revenue each building could generate. In total, we determined the initial operational viability of the Casa Peota startup and outlined a better understanding of the steps needed to continue its development.

4.1 Suitable homes on the Venice market.

In order to find buildings that suit Casa Peota's needs, we narrowed down our search results to buildings that met our goal of housing a full cohort of twenty-four WPI students as well as at least one unit for a Venetian resident. Therefore, we looked for buildings that were independent units, or "*terracielo*" meaning from ground to sky, that were over three hundred square meters and had over five bedrooms. SerenDPT employee Aurora Del Sordo used *immobiliare.it*, an Italian real estate website, to locate houses and reach out to agents in order to set up the house tours. We were then accompanied by Mr. Piero Toffolo to the house tours where he gave us his estimations on potential occupancy and renovation costs as well as his sample reconfigurations. We ended up visiting five houses over the term, located in the Guidecca, Dorsoduro, and Castello neighborhoods of Venice. These properties had list prices ranging from €900,000 to €1,500,000, while their area ranged from 241 square meters to 453 (see Table 2).

Initially, we planned on fitting an entire cohort into one building along with a local Venetian as a superintendent to fill the units during the school terms. However, after conducting our five visits, discussions with Mr. Toffolo, Prof. Carrera, and Mr. Giuman led us to conclude that the most spatially and financially sound way to fit both the students and a resident would be to purchase two initial buildings. That way, we can more easily fit the whole of a WPI cohort and a Venetian resident, as well as using the extra space to rent to tourists year round and produce

higher annual income. The Venetian resident would use the previously discussed rent-to-own model to affordably pay for eventual homeownership.

With this in mind, we needed to select which two of the toured houses to move forward with. We were able to decide on House 1 (Madonna House) and House 4 (L'Arzere House) as Casa Peota's initial buildings due to having the two largest areas and number of floors, most easily allowing the a whole WPI cohort to be housed on top of a separate unit for a Venetian. Although House 2 had the lowest price per square meter, the existing layout of its floors were too difficult and too small to redesign and maximize units. Madonna House and L'Arzere House still had relatively low prices per square meter, especially compared to Houses 3 and 5 (see Table 2).

Table 2 *Toured House Data Comparison*

N.	Nickname	Number of Floors	Commercial Area (meters squared)	List Price	Price per Square Meter
1	Madonna House	4	453	€1,500,000	€3,311
2	Gherardini House	3	343	€900,000	€2,624
3	Biagio House	2	250	€1,350,000	€5,400
4	L'Arzere House	4	400	€1,200,000	€3,000
5	Borgo House	2	241	€1,400,000	€5,809

4.2 Restoration plan for the most viable buildings.

After deciding on Madonna House and L'Arzere House, our next steps were to reconfigure the floor plans in order to better suit Casa Peota's needs by maximizing units in each and including at least 24 beds in one. Using the Venetian building codes provided by Mr. Toffolo (see Table 3), we were able to determine the minimum size required for units with different numbers of beds (see Table 4). He also informed us of the "*antibagno*" which is a required space to separate the kitchen and bathroom that we needed to keep in mind for our renovations.

Table 3 *Room Requirements Per Number of Beds*

Minimum Unit Area			
Number of Beds	**Min. Area (sqm)**	**Window Area (sqm)**	**Height Min. (m)**
1	29	3.625	2.7
2	34	4.25	2.7
3	40	5	2.7
4	46	5.75	2.7

Using Revit and the measurements we took of buildings on site visits, we recreated the current floor plans of each house. We then calculated the square meterage of all the rooms and moved on to redesigning the layouts in order to meet the minimum housing requirements while also maximizing the number of beds that could fit in the building. Preliminary research showed us that a co-housing model would work best for maximizing the number of units in one building, utilizing shared kitchens and common rooms to cut down on the space for each unit. We determined that this layout would work for Madonna House and the students and tourists who will stay there. We created our own Revit models that utilized co-housing strategies in both houses.

We had multiple drafts of the layout of the new configured units for each house. Consulting with Mr. Tofollo's own proposed reconfigurations, we were able to settle on layouts for each house that maximized both the number of units (see Tables 5 and 6). Madonna House's reconfigurations included 24 beds across 5 units while L'Arzere House included 16 beds across 4 units for a total occupancy of 40 between the two. With the number of beds in Madonna House matching our goal of 24, we concluded that this house would individually house all WPI students during their time in Venice. Madonna House's configurations include common living areas and shared kitchens for the co-housing model, while we determined that the best layout for L'Arzere house was a single unit per floor, removing the need for those shared areas. We suggest that the unit on the ground floor in L'Arzere House be the one to house the Venetian resident, as it is the smallest and the larger units on the above floors can be rented out to more short and medium term renters.

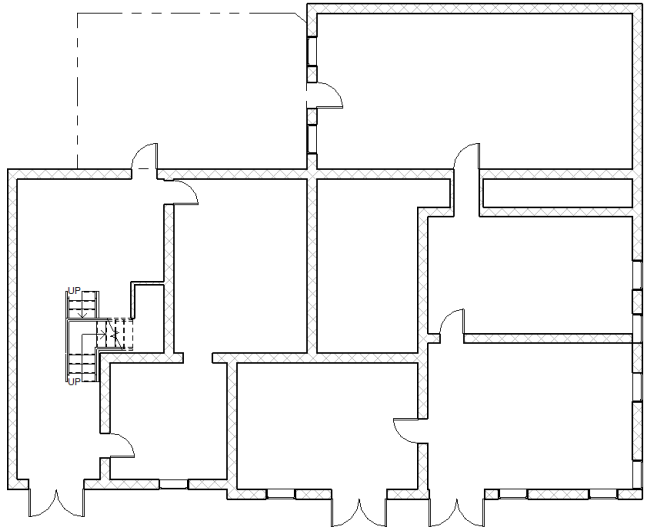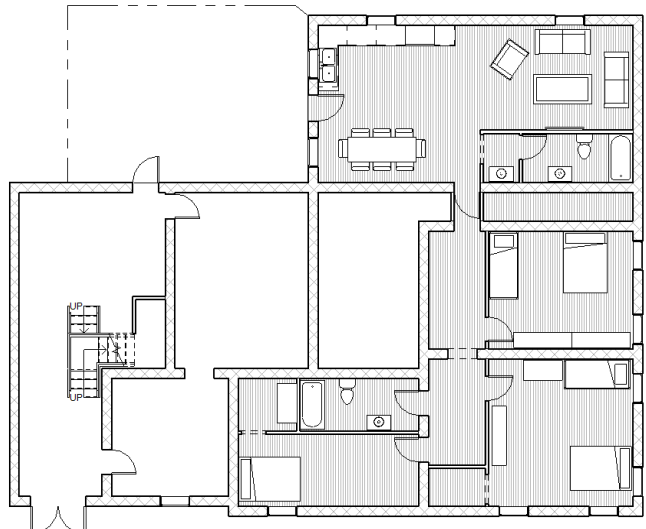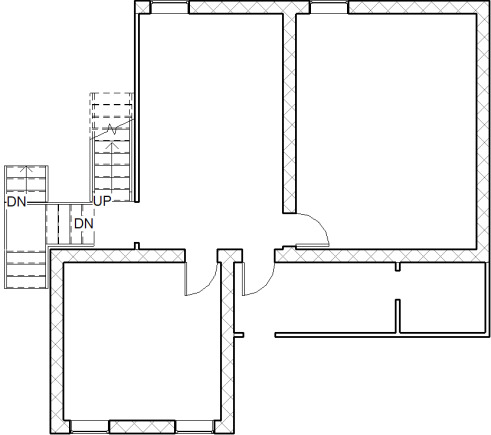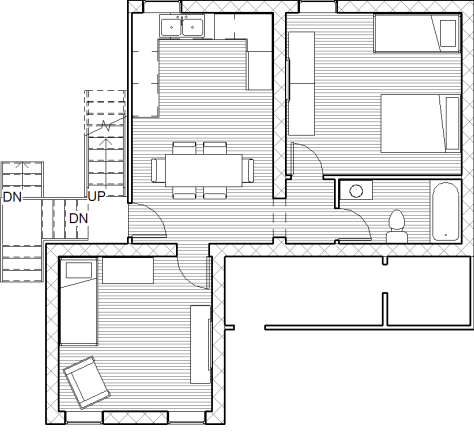**Table 4** *Original Versus Reconfigured Floor Plans of Madonna House*
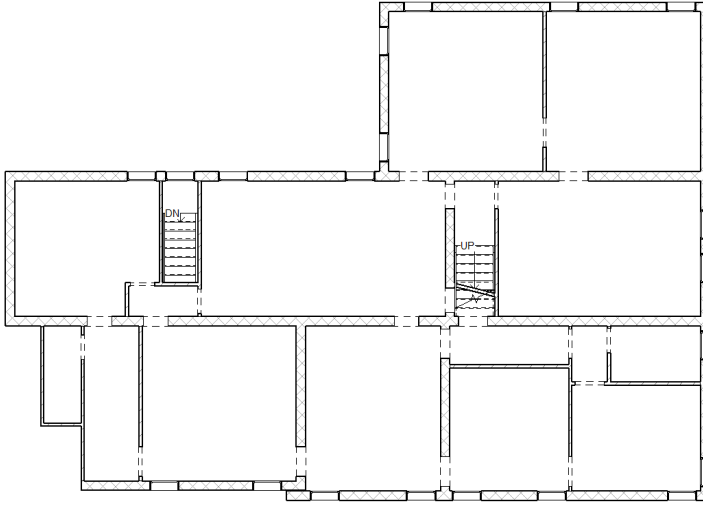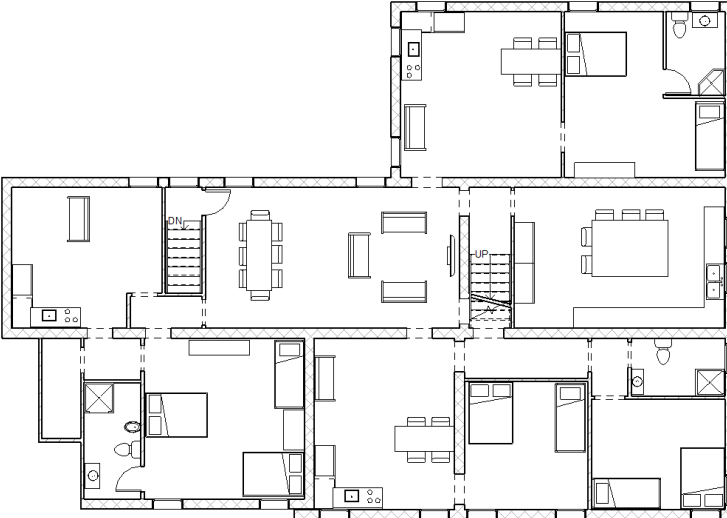
	Original Floor Plan	Reconfigured Floor Plan
Ground Floor		
Mezzanine Floor		
First Floor		

Table 5 *Original Versus Reconfigured Floor Plans of L'Arzere House*

	Original Floor Plan	Reconfigured Floor Plan
Ground Floor		
First Floor		
Second Floor		
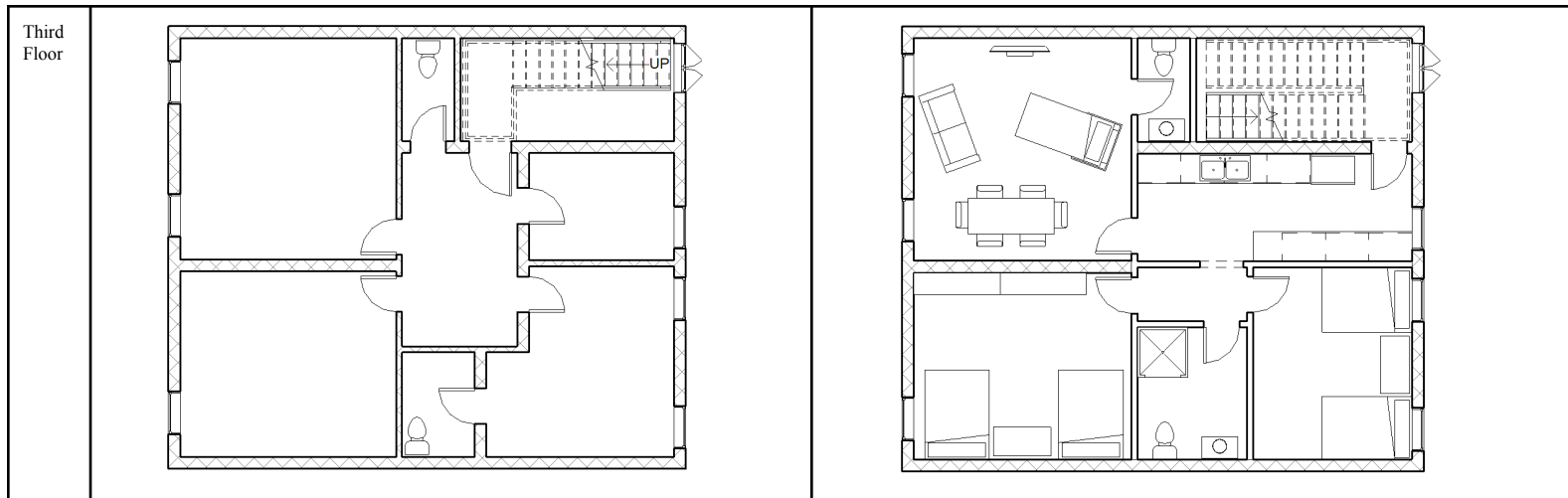
4.3 Analysis of the financials for the purchase, restoration, and rentals.

Using Google Sheets, we created a spreadsheet to outline and track the financial aspects of Casa Peota's concept. These aspects consisted of the buildings list prices, renovation estimates, mortgage rates, operational costs, taxes, and revenue made from rentals. Mr. Toffolo provided the renovation estimates, while the operational costs and relevant taxes were provided by and discussed with Mr. Giuman. The revenue of the apartments was estimated using the current rate paid by WPI to house students each academic term, as well as data gathered from InsideAirbnb to get median prices of short-term rentals in Venice for multiple numbers of renters. With Mr. Giuman, we used all the previous financial categories to build the spreadsheet so that it could be used as a tool with variable inputs to analyze multiple loan and mortgage scenarios.

Assuming a 30-year mortgage on both the Madonna House and L'Arzere House, we found that to start the process of buying and renovating the homes, Casa Peota would need a total of €4,513,500. Because banks typically do not lend the full price of a house, Casa Peota will also need another source of funding, one or many private investors, to cover the remainder of these upfront costs. Using the spreadsheet, we calculated how much yearly payments would cost on both buildings, including the taxes, operational costs, and yearly loan payments. We found that the loan payments for purchasing costs to be €413,600, which breaks down to €278,195 (70%) to the bank and €135,405 (30%) to the private investor yearly. Next, looking at operational costs, we used approximations from Mr. Giuman to calculate a yearly payment of €101,300. The final deduction we looked at was the yearly taxes. Since the buildings create revenue by being used as

short-term rentals, they are subject to the national income tax (24%) as well as the Venice Income tax (3.9%), leading to an estimated payment of €57,258 for the first year which will increase over time as the taxable income increases as well. Finally, we looked at the revenue that the rent for the buildings would generate. We calculated that €246,141 would come in every year from the rent of WPI students, assuming a 70% occupancy rate, €442,294 would come in yearly from STRs, and €6,666 would come in yearly from the initial Venetian resident. This equated to a total yearly revenue of €695,100. Looking at all these factors, we found that Casa Peota would generate €122,942 in profits every year (see Table 7 below). This number varies year to year and due to the taxes not being uniform every year. Each cost and revenue source occurred at different times of the year so we organized the spreadsheet to account for that factor. The following table (Table 8) shows the first year of our spreadsheet that analyzed financials on a month by month basis and the theoretical profit of Casa Peota. This shows that following this model, Casa Peota will always have money saved up, and will continue to save over time.

Table 6 *Yearly Financials By Category*

Yearly Financials			
Category	**Breakdown**	**Breakdown Value**	**Total Cost/Profit (€)**
Purchase Costs	Mortgage	€278,200	413,600
	Private Investor	€135,400	
Operations Costs			101,300
Taxes	IRES - National	24%	57,258
	IRAP - Venice	3.9%	
Revenue Made (assuming 70% occupancy rate)	WPI Student Rent	€246,141	695,100
	STR Rent	€442,294	
	Venetian Rent	€6,666	
Profit (varies yearly)			122,900

Table 7 *Monthly Cost Breakdown of First Year*

Month	Year	Revenue	Operational Costs	Interest	Principal	PI Payment	Taxes	Monthly Profit	Cash on Hand
Jan	1	€51,388	€7,717	€21,063	€17,270	€0	€0	€5,338	€5,338
Feb	1	€145,156	€7,717	€20,948	€17,385	€0	€0	€99,106	€104,444
Mar	1	€28,338	€5,717	€20,832	€17,501	€0	€0	-€15,712	€88,732
Apr	1	€75,418	€5,717	€20,715	€17,618	€0	€0	€31,368	€120,099
May	1	€16,813	€7,717	€20,598	€17,735	€0	€0	-€29,237	€90,862
Jun	1	€28,338	€10,717	€20,480	€17,853	€0	€0	-€20,712	€70,150
Jul	1	€51,388	€5,717	€20,361	€17,972	€0	€0	€7,338	€77,488
Aug	1	€51,388	€7,717	€20,241	€18,092	€0	€0	€5,338	€82,826
Sep	1	€145,156	€5,717	€20,120	€18,213	€0	€0	€101,106	€183,932
Oct	1	€39,863	€5,717	€19,999	€18,334	€0	€0	-€4,187	€179,744
Nov	1	€16,813	€5,717	€19,877	€18,456	€0	€0	-€27,237	€152,507
Dec	1	€34,101	€25,410	€19,753	€18,579	€135,405	€0	-€29,642	€122,865

We also determined that, in the apartment of the L'Arzere House that a Venetian would be purchasing using a rent-to-buy model, they would need to rent from Casa Peota for eight years and pay back 20% of the value of the apartment during that time. This time frame would allow them to pay back the 20% (€53,327) in affordable, monthly payments of €555.

Another aspect we analyzed was the risk taken on by creating a business and taking out loans worth millions of euros. As seen in the graph of cash on hand over time (Figure 5), the two bank loan lengths we considered were 30 years and 20 years. In both instances, the total cash on hand remains positive and increases over time meaning they are both feasible. In comparison to the 30-year loan, the 20-year loan has less total cash on hand for over 20 years meaning Casa Peota takes on greater risk during that time because there is less cushion in case of sudden negative impact from an outside factor. On the other hand, the 20-year loan is paid off quicker, meaning less money is paid in total as interest to the bank and more total profit can be made in the long run. The spreadsheet can be used to test different loan scenarios so Casa Peota can visualize risk and profit tradeoffs.
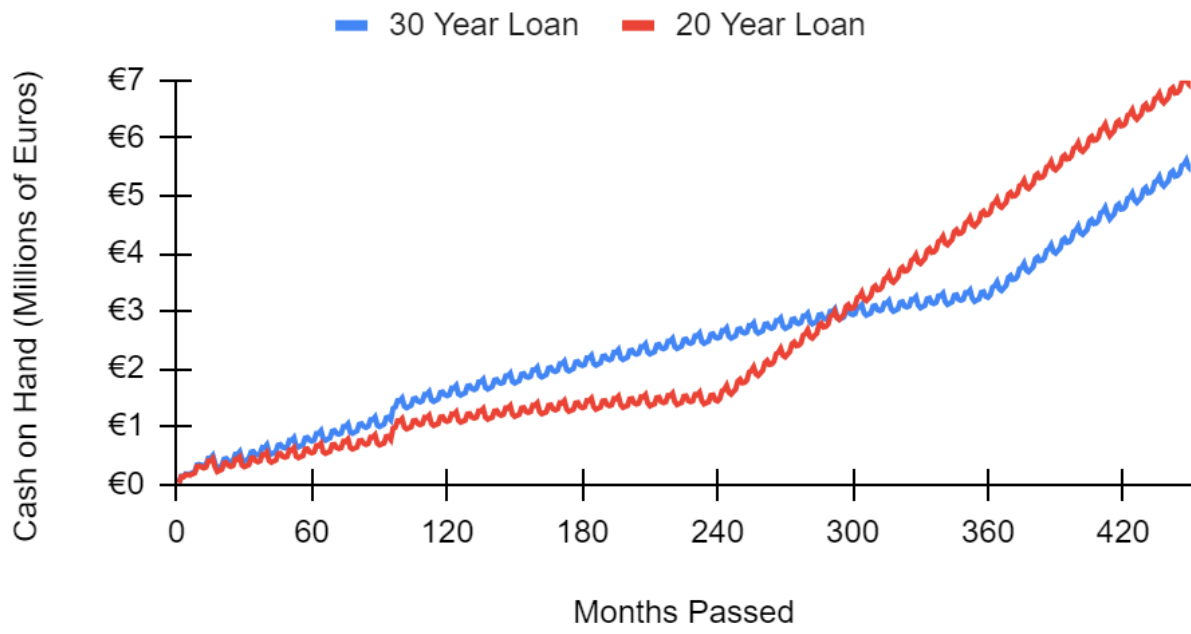
Figure 5 *Comparison of Cash on Hand Over Time for 30 vs 20 Year Mortgage*

5.0 Discussion

The Casa Peota concept model went through many different stages before a viable framework was found. Through lots of trial and error, it was decided that the best business model would take the form of two initial buildings being purchased and renovated simultaneously. Initially, the team looked into focusing on just the Madonna House, as a means to collect a large revenue to put towards another building as quickly as possible. Since the Madonna House can house the entirety of the WPI cohort that visits in a term, it was chosen to be a "cash cow" for the model. Originally our predicted revenues from the WPI cohorts as well as STRs in non-WPI months would allow Casa Peota to front the downpayment and renovations of the next building for the project. The problem with this model was that it could not fit all 24 WPI students as well as a Venetian resident, so it was decided that two initial buildings would help Casa Peota deliver on its mission faster. While this model requires Casa Peota to cover a much larger down payment, as well as find an investor to do so, it allows the startup to house a Venetian immediately, and the extra units would be profitable as year round STRs. Once the buildings are paid off, STR units in L'Arzere House can be converted to units for Venetians to reside in permanently, using a rent-to-own payment plan towards Casa Peota, while the extra revenue from Madonna House can be saved and put towards the down payment and renovation costs of another building, to follow the same model L'Arzere House does.

6.0 Conclusions and Recommendations

Based on the houses selected, the renovations proposed, and the financials estimated, we found that the Casa Peota concept would be viable and the startup would be profitable using typical mortgage parameters. We found that the use of two buildings in the initial stages allows Casa Peota to deliver on its mission of providing affordable housing to a Venetian resident faster. Madonna House will be able to host the future WPI students completing Interactive Qualifying Projects while L'Arzere House will be able to accommodate the initial Venetian resident or couple, as well as the three short-term rental units. Through our research, we found that the WPI students' rent plays a critical role in the foundation of Casa Peota, as without the secured rent of over 60 WPI students visiting yearly, Casa Peota would not make enough yearly profit to support the buildings the startup looks to purchase. We found that with a mortgage length of 30 years, which is the most common length, the Casa Peota model would be financially feasible and still have excess profit each year to build savings toward purchasing another building. This shows that since an expensive building with a standard mortgage is affordable with a 30% private investment, once cheaper buildings are found they will also be affordable for Casa Peota. The financial spreadsheet can be very useful to Casa Peota in that the user can change the mortgage parameters to determine different financial projections for different scenarios. From there, more conclusions on what mortgage parameters would best accomplish certain goals can be determined.

We recommend that future groups working through the next steps for Casa Peota to take real form should work on several components that will be critical in developing and running the startup. These components include finding an initial source of funding, as well as developing a contract for the relationship between Casa Peota and the initial Venetian resident. While we considered them to be using rent-to-own to buy their unit within the L'Arzere house, we recommend looking into how the financials would work out if they were using host-to-own with the other units within the building. That way, the Venetian resident could act as a superintendent to the rest of the STRs and even make their own profit from those. It would be important to consider what the financial transactions would look like for that position. For the purpose of these scenarios, we recommend future groups create a sample legal agreement between Casa Peota and the residents, ensuring that once they own the building they won't be able to turn it back into a tourist rental. Finally, we suggest future teams working with Casa Peota use our

original spreadsheet and create a function to be able to map out how soon units could be sold to Venetians within the L'Arzere house while still ensuring the startup is making a profit for future buildings in the project.

7.0 References

30-Year Fixed Rate Mortgage Average in the United States. (2023, September 14). FRED, Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/MORTGAGE30US

Allouhi, A., El Fouih, Y., Kousksou, T., Jamil, A., Zeraouli, Y., & Mourad, Y. (2015). Energy consumption and efficiency in buildings: current status and future trends. *Journal of Cleaner Production*, *109*, 118–130. https://doi.org/10.1016/j.jclepro.2015.05.139

Arrigoitia, M. F., & West, K. (2021). Interdependence, commitment, learning and love: the case of the United Kingdom's first older women's co-housing community. *Ageing and Society*, *41*(7), 1673–1696. https://doi.org/10.1017/S0144686X19001673

Asadi, E., Silva, M. G. da, Antunes, C. H., Dias, L., & Glicksman, L. (2014). Multi-objective optimization for building retrofit: A model using genetic algorithm and artificial neural network and an application. *Energy and Buildings*, *81*, 444–456. https://doi.org/10.1016/j.enbuild.2014.06.009

Barron, K., Kung, E., & Proserpio, D. (2020). *The Effect of Home-Sharing on House Prices and Rents: Evidence from Airbnb* (SSRN Scholarly Paper 3006832). https://doi.org/10.2139/ssrn.3006832

Beck, A. F. (2020). What Is Co-Housing? Developing a Conceptual Framework from the Studies of Danish Intergenerational Co-Housing. *Housing, Theory and Society*, *37*(1), 40–64. https://doi.org/10.1080/14036096.2019.1633398

Bertocchi, D., & Visentin, F. (2019). "The Overwhelmed City": Physical and Social Over-Capacities of Global Tourism in Venice. *Sustainability*, *11*(24), 6937. https://doi.org/10.3390/su11246937

Biennale Arte 2022 | The Biennale Arte 2022 closes with over 800,000 tickets. (2022, November 26). La Biennale Di Venezia. https://www.labiennale.org/en/news/biennale-arte-2022-closes-over-800000-tickets

campaignforalivingvenice. (2018, September 26). Airbnb out of control in Venice, properties double in 3 years. *Campaign For A Living Venice*. https://campaignforalivingvenice.org/2018/09/26/airbnb-out-of-control-in-venice-properties-double-in-3-years/

Carrera, F. (2020). *Exploration of Venice: Contexts and Trends of Social Exclusion, Forms of Coping and Innovative solutions* (SMARTDEST). SerenDPT.

casa-Venezia, O., Osservatorio indipendente sulla. (2020, June 13). Se si parla di politiche residenziali c'è poco da festeggiare. *OCIO Venezia*. https://medium.com/ocio-venezia/se-si-parla-di-politiche-residenziali-c%C3%A8-poco-da-festeggiare-48e22556db0c

Case in vendita - Immobiliare.it. (n.d.). Retrieved December 12, 2023, from https://www.immobiliare.it/

CB165720. (2020, February 12). *Regolamento Edilizio* [Text]. Comune di Venezia. https://www.comune.venezia.it/it/content/regolamento-edilizio

Crace, M. (n.d.). *How Much Do You Really Need For A Down Payment?* Retrieved December 7, 2023, from https://www.rocketmortgage.com/learn/how-much-down-payment-for-a-house

DI250000. (2022, April 18). *Popolazione residente* [Text]. Comune di Venezia. https://www.comune.venezia.it/it/content/serie-storiche

Holtzman, B. (2017). "I Am Not Co-op!": The Struggle over Middle-Class Housing in 1970s New York. *Journal of Urban History*, *43*(6), 864–885. https://doi.org/10.1177/0096144217714759

Horn, K., & Merante, M. (2017). Is home sharing driving up rents? Evidence from Airbnb in Boston. *Journal of Housing Economics*, *38*, 14–24. https://doi.org/10.1016/j.jhe.2017.08.002

Ianniello, G., & Cánoves, G. (2022). TOURISMIFICATION IN VENICE (ITALY): A STUDY ON THE EFFECTS OF MASS TOURISM ON A HISTORIC CITY BUILT ON A LAGOON ISLAND. *Cuadernos de Turismo*, *49*, 173–187. https://doi.org/10.6018/turismo.521861

International Code Council, Inc. (2021). *2021 International Building Code* (Version 2). International Code Council, Inc. https://codes.iccsafe.org/content/IBC2021P2

Italian Payroll – Italian Payroll. (n.d.). Retrieved December 12, 2023, from https://www.italianpayroll.it/

Loftium. (n.d.). Retrieved December 12, 2023, from https://loftium.com/host_to_own

Real estate market Venezia - Immobiliare.it. (n.d.). Retrieved September 14, 2023, from https://www.immobiliare.it/en/mercato-immobiliare/veneto/venezia/

Rent-To-Own Your Dream Home | Divvy. (n.d.). Retrieved December 12, 2023, from https://www.divvyhomes.com/

Salerno, G.-M., & Russo, A. P. (2022). Venice as a *short-term city* . Between global trends and local lock-ins. *Journal of Sustainable Tourism*, *30*(5), 1040–1059. https://doi.org/10.1080/09669582.2020.1860068

Sammartino, A. H. (2022). *Freedomland: Co-op City and the Story of New York*. Cornell University Press. https://doi.org/10.1515/9781501716454

Sampaoli & Pellacchia Law Firm. (2022, April 23). Guide to short term rentals regulations in Italy. *S&P Law Firm in Italy*. https://splawfirm.eu/rental-house-italy/guide-short-term-rentals-regulations-italy/

Smartdest. (n.d.). Retrieved December 12, 2023, from https://smartdest.eu/

Sørvoll, J., & Bengtsson, B. (2020). Mechanisms of Solidarity in Collaborative Housing – The Case of Co-operative Housing in Denmark 1980–2017. *Housing, Theory and Society*, *37*(1), 65–81. https://doi.org/10.1080/14036096.2018.1467341

Torgal, F. P., Granqvist, C. G., Jelle, B. P., Vanoli, G. P., Bianco, N., & Kurnitski, J. (2017). *Cost-Effective Energy Efficient Building Retrofitting: Materials, Technologies, Optimization and Case Studies*. Woodhead Publishing.

Törnqvist, M. (2019). Living Alone Together: Individualized Collectivism in Swedish Communal Housing. *Sociology*, *53*(5), 900–915. https://doi.org/10.1177/0038038519834871

U.S. Census Bureau. (2023a, July 26). *Average Sales Price of Houses Sold for the United States*. FRED, Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/ASPUS

U.S. Census Bureau. (2023b, September 12). *Real Median Household Income in the United States*. FRED, Federal Reserve Bank of St. Louis. https://fred.stlouisfed.org/series/MEHOINUSA672N

Venice. (n.d.). Retrieved December 10, 2023, from http://insideairbnb.com/venice/

Venice population. Why do so many Venetians escape Venice? (2019, October 2). https://allaboutvenice.com/venice-population/

Wilson, L. (2022, July 7). How Big is a House? Average House Size by Country - 2023. *Shrink That Footprint*. https://shrinkthatfootprint.com/how-big-is-a-house/

8.0 Appendices

Appendix A: Interview Questions for Architects, Real Estate Agents, and Contractors

1. Are all of these floors habitable? (ie. Has there been water damage to the foundations or basements?)

2. Is the roof accessible?

3. Is this whole building dedicated to residence or is it split? (ie. Are there stores or businesses on the ground floor with residence above?)

4. Can you identify the load-bearing walls in this building?

5. When was the last time this building was updated?

6. Is this building considered "historical?" (ie. Is the building's exterior allowed to be updated?)

7. What aspects of the original building, in your opinion from professional experience, can be salvaged?

Appendix B: Renovations to Increase Energy Efficiency

Some renovation options are considered "passive energy saving technologies," including "advanced building envelopes, passive heating or cooling, and thermal energy storage," (Cao et al., 2016, p. 203). These are "essentially dependent on solar heat gain," but can have maximized results when thermal insulation is taken into consideration (Cao et al., 2016, p. 203). One such example is by reducing the "wall-to-window ratio," and the use of "window glazing materials with low U-values," which can "effectively decrease electricity consumption for both lighting and air conditioning applications," (Cao et al., 2016, p. 203).

Another popular passive heating technique is a "solar gain wall (Trombe wall)," which "effectively traps and transmits solar energy into a building," (Cao et al., 2016, p. 203). Figure 5 (shown below) demonstrates how a Trombe wall can be applied as a passive heating technique. A modified version could also be explored in order to assist with a passive cooling method known as "nighttime building ventilation," which uses "colder night air to attenuate heat gains during the daytime, thus avoiding summer overheating and reducing cooling energy consumption," (Cao et al., 2016, p. 203). The implementation of passive heating and cooling

strategies could potentially have the biggest positive impact on renters and the environment as "HVAC systems account for almost half of building energy consumption and approximately 10-20% of total energy consumption in developed countries," (Cao et al., 2016, p. 203).
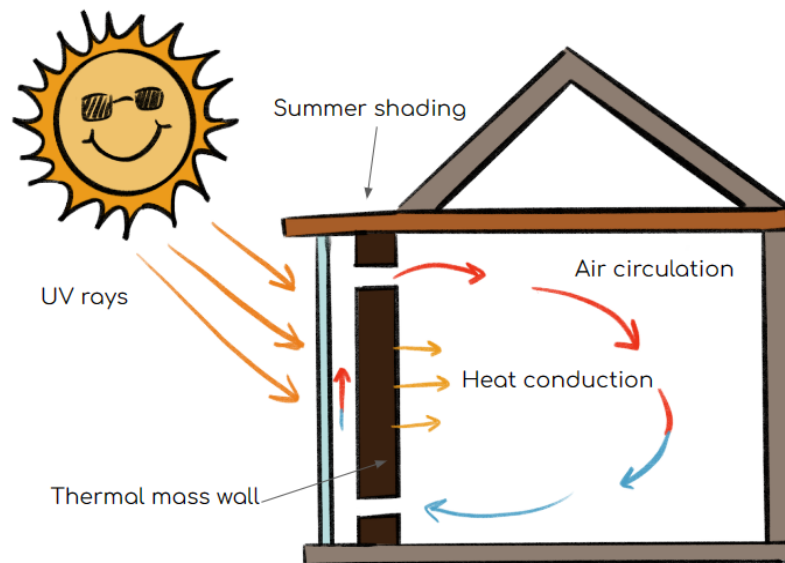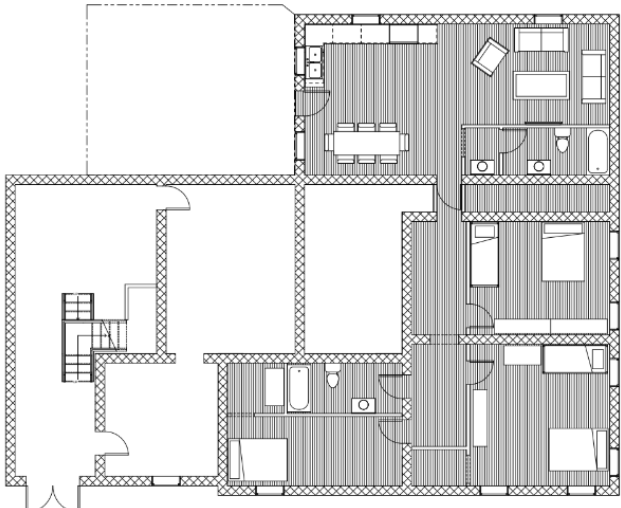

Figure 6 *Trombe Wall Diagram*

The implementation of passive heating and cooling strategies could potentially have the biggest positive impact on renters and the environment as "HVAC systems account for almost half of building energy consumption and approximately 10-20% of total energy consumption in developed countries," (Cao et al., 2016, p. 203).

Furthermore, the upgrade of regular light bulbs to LEDs can improve energy efficiency in homes as well "due to their long service life and good lighting efficacy," (Cao et al., 2016, p. 204). Also, the installation of a dimming or automatic shut-off mechanism, whether controlled by the resident or a daylight sensitive-sensor, can significantly reduce the electricity used for lighting, (Cao et al., 2016).

Since solar panel installation is not an option, a "green roof," or at least a rooftop garden could serve as both a "practical way to lower indoor temperatures and mitigate urban warming," while also providing residents with a nature-filled communal space to enjoy and relax in (Cao et al., 2016, p. 203). Studies show that green roofs have a "payback period of approximately 8.5 years," and when covering an "area of 10000m²," they "helped reduce the annual cooling needs of an Athens office building by 19%," (Cao et al., 2016, p. 203).

Appendix C: Proposed Renovated Floor Plans

Links to full renovated floor plans embedded in the cover pages above. Full links provided below.

Madonna House:

https://drive.google.com/file/d/1We5Vd6fc5PDRQinOmPpEENcOpwpkK02B/view?usp=drive_l ink

L'Arzere House:

https://drive.google.com/file/d/1yXsc0xgiT9ahY3iqtHx4PrrckcA_wgZp/view?usp=drive_link

Appendix D: Property Portfolios

The team created dossiers of the selected buildings as a way to consolidate the important information from each house. These can be used as templates for future teams that can bring the dossiers to banks, private investors, or anyone else interested in the project to try and secure funding for the program.

https://docs.google.com/presentation/d/1VJe-iRJXt--8YO_lku2Si7DlhIdhjQW7XKNT7kgsKIY/ edit?usp=sharing
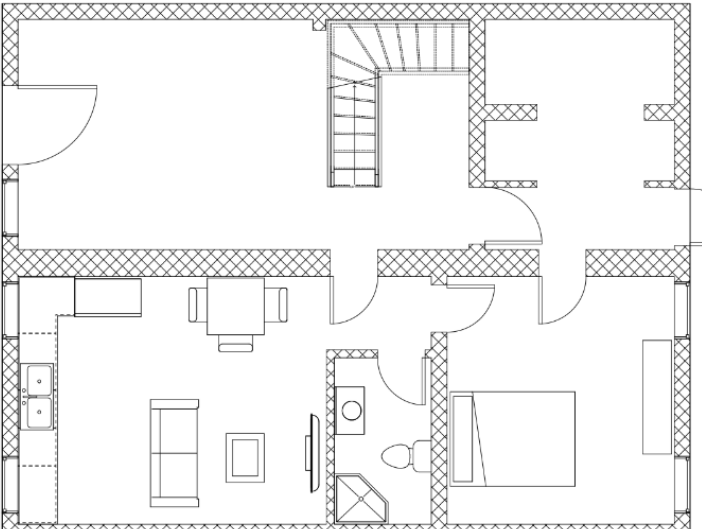
L'ARZERE HOUSE DOSSIER
Fondamenta de L'Arzere, 2257, 30100 Venezia VE, Italy

Built in:	5 bedrooms
1800	**5 bathrooms**
Commercial Area:	4 floors
400 sq. meters	**18 rooms**
Actual Area:	Courtyard
284 sq. meters	

Link to Website:
https://www.engelvoelkers.com/it/exposes/396decc8-d418-55e7-b295-f2890209d5ab

Links to full dossiers embedded in the cover pages above. Full link provided below each cover page.

https://docs.google.com/presentation/d/1-JA9BWi-OZoyjXRXYTQe6u00_wOcq0tm0A0mpWSf3m k/edit?usp=sharing

Appendix E: Building Financial Data

The team created a flexible spreadsheet using Google Sheets in order to explore multiple financial projections using different variables.

Month	Year	Principal	PI Payment	Taxes	Monthly Profit	Cash on Hand
Jan	1	€11,576	€0	€0	€10,587	€10,587
Feb	1	€11,654	€0	€0	€104,355	€114,941
Mar	1	€11,731	€0	€0	-€10,463	€104,478
Apr	1	€11,810	€0	€0	€36,617	€141,095
May	1	€11,888	€0	€0	-€15,851	€125,244
Jun	1	€11,968	€0	€0	-€7,326	€117,918
Jul	1	€12,047	€0	€0	€12,587	€130,505
Aug	1	€12,128	€0	€0	€10,587	€141,092
Sep	1	€12,208	€0	€0	€106,355	€247,447
Oct	1	€12,290	€0	€0	€1,062	€248,508
Nov	1	€12,372	€0	€0	-€21,988	€226,520
Dec	1	€12,454	€0	€0	-€24,393	€202,127

Link to full spreadsheet embedded in the screenshot above. Full link provided below.

https://docs.google.com/spreadsheets/d/1jAG0hJQJyMwi8hR61rmYpYdx6eVMq18eZovrEBm6C Nc/edit?usp=sharing