



**SCHOOL OF ARCHITECTURE, ENGINEERING, LAND AND
ENVIRONMENTAL SCIENCES**

**PROPERTY PRICES AND URBAN SPRAWL IN LIMASSOL:
CHALLENGES FOR SUSTAINABLE URBAN DEVELOPMENT**

ANGELINA PIRIKKI

08/2024



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**Dissertation which was submitted for obtaining a Master's
degree in Real Estate at Neapolis University**

ANGELINA PIRIKKI

08/2024

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VALIDITY PAGE

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DECLARATION

I, Angelina Pirikki, being fully aware of the consequences of plagiarism, declare responsibly that this paper entitled "Property Prices and Urban Sprawl in Limassol: Challenges for Sustainable Urban Development" is strictly a product of my own personal work and that all sources used have been duly stated in the bibliographic citations and references. Where I have used ideas, text, and/or sources of other authors, they are clearly mentioned in the text with the appropriate citation and the relevant reference is included in the bibliographic references section with a full description.

The Declarant

Angelina Pirikki

Summary

Η πόλη της Λεμεσού καλείται να αντιμετωπίσει προβλήματα που προκύπτουν το σύγχρονο φαινόμενο της παγκοσμιοποίησης και της ελεύθερης διακίνησης του πληθυσμού. Η προσέλκυση επενδυτών και υψηλά εισοδηματικά εργατικού δυναμικού έχει οδηγήσει το νησί σε σημαντική οικονομική μεγέθυνση χωρίς ωστόσο οικονομική ανάπτυξη. Οι αυξημένες αξίες των ακινήτων λόγω της απρόσμενης αύξησης της ζήτησης και της χαμηλής προσφοράς, σε συνδυασμό με της διάφορες γεωπολιτικές συνθήκες που επικρατούν στην περιοχή έχουν οδηγήσει σε αύξηση του πληθωρισμού και των επιτοκίων δανεισμού. Οι αυξημένες τιμές των ακινήτων ολοένα και αυξάνονται με αποτέλεσμα την διεύρυνσης του χάσματος μεταξύ των οικονομικών τάξεων και της περιθωριοποίησης του τοπικού πληθυσμού. Η οικιστικές πιέσεις που δέχεται η πόλη, λόγω γης αύξησης του πληθυσμού, έχουν οδηγήσει σε αστικό εξευγενισμό, αστική διάχυση και επιβάρυνση του περιβάλλοντος καθώς οι αγοραστές αναζητούν οικονομικότερες λύσης στέγασης σε περιοχές με χαμηλότερη αξία γης. Με την χρήση εφαρμογών τηλεπισκόπισης, αναγνωρίζουμε το πρόβλημα της αστικής διάχυσης, δημιουργούμε θεματικούς χάρτες και με βάση τα αποτελέσματα μετρούμε τον βαθμό της αστικής διάχυσης στην Λεμεσό. Συγχρόνως, εντοπίζουμε τις περιοχές που επιβαρύνονται περισσότερο γύρω από την αστικό ιστό και την κατεύθυνση της ανάπτυξης. Παράλληλα με την αξιοποίηση στατιστικών δεδομένων εξετάζουμε τις πληθυσμιακές, οικονομικές και περιβαλλοντικές επιπτώσεις της. Αξιοποιώντας τα ευρήματά μας, αναζητούμε τρόπους άρσης του προβλήματος και εξυγίανσης των επιπτώσεων του.

Keywords: urban sprawl, property prices, affordability, sustainability, remote sensing.

Abstract

The city of Limassol is called upon to face problems arising from the modern phenomenon of globalization and the free movement of the population. The attraction of investors and high-income labor force has led the island to significant economic growth without economic development. The increased real estate values due to the unexpected increase in demand and low supply, combined with the various geopolitical conditions prevailing in the region, have led to an increase in inflation and lending rates. Increased real estate prices are ever increasing resulting in a widening gap between economic classes and the marginalization of the local population. The housing pressures the city faces, due to population growth, have led to urban gentrification, urban sprawl and environmental burden as buyers look for cheaper housing solutions in areas with lower land value. By using remote sensing applications, we identify the problem of urban sprawl, create thematic maps, and based on the results, measure the degree of urban sprawl in Limassol. At the same time, we identify the most burdened areas around the urban core and the direction of development. Alongside the utilization of statistical data, we examine its population, economic and environmental effects. Using our findings, we are looking for ways to eliminate the problem and consolidate its effects.

1. Introduction

Urban sprawl in Limassol is a recent phenomenon which seems to arise from the rapid increase in property prices due to the introduction of a new high-income population as well as due to the general monetary policy, increase in interest rates and inflation, which has simultaneously led to an increased demand for housing but the inability to secure it from the local population. Increased population is the number one reason for urban sprawl across the world. Where the urban stock fails to meet the needs of the population, residents migrate to areas where they can find the best quality of life based on their economic potential.

The present research studies the case of the city of Limassol in Cyprus, which receives significant housing pressures both from the newly arriving population and from the locals, with each having completely different preferences and needs. As the increased prices are not reflected in the incomes of the local population who are unable to cope with the economic challenges, they are “forced” to move to suburban areas. However, intense suburbanization without an organized urban planning or development plan, leads to unregulated construction in agricultural and even industrial areas which receive intense development pressures and challenges in order to cope with the pressures they face from the unexpected migration of the population (Yasin, 2020). Areas that lack the necessary infrastructure such as transport, electricity and water supply are called upon to house a new population and satisfy the basic needs of a house. In this study we aim to examine:

1. How do increased real estate prices lead to urban sprawl and the gentrification of the urban center
2. Is urban sprawl a threat to sustainable development?
3. How can urban sprawl be reduced and at the same time housing needs be met?

In Limassol, the unaffordability issues have pushed the population to the suburbs, with the result being an increased need to alleviate the traffic problem, improve existing and create new infrastructure in suburban areas with an extensive reduction of the suburban natural environment.

The global bibliography agrees that urban sprawl strongly affects not only the environment and the economy but also human health. Therefore, the necessity of limiting the problem to achieve an optimal quality of life in a sustainable market is emphasized.

The objective is to determine how rising costs cause urban sprawl and gentrification in urban areas, and how this sprawl degrades the environment and impedes sustainable development. Acknowledging these issues, strategies are put forth to limit urban sprawl while maintaining a sufficient supply of housing to meet demand at all levels. The lack of housing is a significant social issue for all societies. This study highlights the unique nature of the housing shortage and the necessity of addressing it in modern sustainable societies.

2. Literature review

2.1. Challenges of urban sprawl

Urban sprawl is considered one of the most challenging urban phenomena and a barrier to achieving sustainable development (Shawly, 2022). In scientific literature, many researchers have tried to analyze and interpret the factors that cause urban sprawl as well as its effects from a social, economic and environmental point of view both at a global and national level. Lepetit, Vigui  a and Liotta (2023) analyzed data such as population density, travel time and distance from the city center in 192 urban areas worldwide to examine urban sprawl, affordability and access to transport infrastructure. Research on the impact of CO2 emissions in 206 cities and regions over a 58-year period, 1960–2018, concluded that increasing migration trends necessarily create a development cycle between urban sprawl and urban transport resulting in increased energy use and carbon footprint (Lepetit, et al., 2023). The transport sector directly contributes to greenhouse gas emissions by approximately 14% of total emissions) (Sarkodie, et al., n.d.).

Rob et al, in the book "Hot Property - The Housing Market in Major Cities " point out that urbanization has a huge influence on increasing property prices in cities creating affordability problems. Affordability is identified as “a pressing issue everywhere in the world” and the popularity of cities is the driving force behind urban sprawl. In chapter 1, Doorn, Arnold, and Rapoport state that rapid population growth and city competitiveness results in rising property prices, a lack of housing units and a lack of purchasing power, resulting in social segregation and the search for new areas to live in. At the same time, it is emphasized that successful cities must face challenges and achieve conditions of balance by managing and resolving housing shortages and unaffordability (Van Doorn, et al., 2019).

This crisis of unaffordability within large urban areas depends mainly on the underlying wage and income inequalities as well as on the sharp increase in the value of residential real estate due to the concentration of employment and amenities and to a lesser extent on housing regulation (Rodriguez & Storper, 2019). Hosseini and Hajilou (2018) highlight that 76.9% of the urban sprawl phenomenon in Iran is explain by population growth, land value, political factors and management, land speculation, transportation, policies, external

pressure, and land use, where the population growth caused by urbanization has the highest impact (Hosseini & Hajilou, 2015).

Cyprus is faced with tremendous population growth which is the main cause of urban sprawl. This is due to the attraction of the new population and workforce. Cyprus ranks as the 3rd most popular destination for immigrants in the EU. For 2024, the current net immigration rate on the island reaches 4,056 per 1,000 population (Macrotrends, 2024). The mild climate, the sunshine most days of the year and the relatively affordable cost of living attract a large number of foreigners. The most popular city among foreigners is Limassol (Buglo, 2024).

At almost one million, Cyprus is home to a small population. With 4.056 net migration per 1,000 inhabitants, there are significantly more newcomers to the population than there are in larger nations, which may have a greater influence. Social harmony depends on immigrants integrating successfully.

For a smaller nation like Cyprus, the number of immigrants is comparatively high. Additionally, the lack of sufficient planning and resources has resulted in strain on the infrastructure and public services, raising the possibility of social and economic difficulties.

Sprawl is explained as urban growth and low density, a situation that creates decentralization with no clear reasons (Xiaoxiao, et al., 2020). It is divided into two types: urban decentralization and urban renewal. However, urban sprawl mostly has negative effects on urban growth. Despite that, governments seem to promote sprawling development as they benefit greatly from the land tax, charges on land leasing, and various land use fees. Nevertheless, the municipalities that are located at a short distance from the cities and are the places of relocation also seem to benefit from urban sprawl. The advantages arise not only from the collection of taxes from the new residents but also from the creation of economies of scale (Łukomska, & Neneman, 2020). Services and schools are now being attracted to these areas, while local costs per inhabitant are decreasing due to the increase in population. This is also observed in Limassol, as in many newly built peri-urban areas we observe the significant expansion of the road network as well as the construction of schools of all levels as well as sports facilities.

In contrast, the losses incurred by households due to suburbanization appear to be enormous. Households that make the decision to relocate to the suburbs appear to face significant financial losses in the cost of travel to the city, mainly for work, education and shopping (Lityński & Hołuj, 2017). Particularly, in the example of Australia, it seems that more than one third of income of low-income households is spent on housing costs whereas many other households struggle to find a place to live due to high housing costs (Han, et al., 2021). As a result of this poor decision making and failure of public planning policy, this leads to premature land use conversion and unnecessary increases in public utilities, infrastructure and amenities in order to cover the gap from relocations (Yasin, et al., 2021).

Sprawl is also pointed out as “a violent development of suburban areas” with many negative consequences for both residents and the environment, affecting water and air pollution and causing increased traffic. It is considered a long-term problem which transforms arable land into a buildable environment with new housing, industrial and commercial sites as well as transport infrastructure (Spirkova, et al., 2020).Kamran at al (2020) state that the quality of the environment is shaped by urban developments in urban and suburban areas and urban sprawl always has damaging effects on agriculture and nature. At the same time, beyond the exploitation of arable land by urbanization, the phenomenon of the heat island effect, is created with a significant increase in the average temperature and the further impact on the environment (Izakovičová, et al., 2022).

It is also necessary to harmonize urban sprawl with the Sustainable Development Goals (SDGs) (Nubi, et al., 2021) in order to achieve the transformational vision of saving the planet. It has been discussed that it is in direct conflict with goal 11, "make cities and human settlements inclusive, safe, resilient and sustainable". At the same time, it affects goals 12, 13 and 15 which are related to sustainable consumption and production, climate change and quality of life and ecosystems respectively. It is very important that Limassol has committed to achieving the goals by 2030.

2.2. Global background

The first cities to begin experiencing urban sprawl were the central and western United States. However, this urban model of scattered development was quickly transferred to Latin

America, and later, to many Asian and European cities. In the United States, urban sprawl began to manifest from the mid-1920s and accelerated after 1950 as a result of the post-war era and mass car ownership that allowed for faster commutes to the city. This upward trend continued until the 1990s, when it began to decline due to the doubling of fuel prices as well as new reforms to promote smart growth and New Urbanism (Barrington-Leigh & Millard-Ballb, 2015).

From the research of Barrington-Leigha and Millard-Ballb, it appears that urban sprawl was significantly influenced by the construction trends of the time as well as the connectivity of the roads and the quality of the road network (Barrington-Leigh & Millard-Ballb, 2015). Areas with greater road stock and better peri-urban connectivity such as Atlanta and Charlotte have recorded the highest level of sprawl for new construction over the period 1999–2013. To address sprawl and mitigate its impacts, local policies had been adopted to control expansion, promote denser, mixed-use, connected development patterns.

In Latin America, the private market, single-family housing and the "suburban dream" contributed greatly to urban sprawl with urban sprawl observed around transport infrastructure. At the same time, the need for housing affordability and policies for housing low-income groups maximizing public benefits have led to the supply of more affordable housing in cheaper land beyond urban areas.

In the city of Chile-Santiago on average there were about 8,000 families per year with approved subsidies for housing but without available land within the city borders; resulting in the allocation of agricultural and vacant land to the peri-urban cycle. This phenomenon was reinforced by the effort to eliminate slums from central areas in a strategy of gentrification and upgrading of the urban center. However, the beneficiaries of such subsidies, were people with low incomes, depended to a great extent on public transport, as a result of which the allocation of agricultural land presupposes the construction of the necessary infrastructure to serve them (Silva & Perucich, 2021) with significant results in the suburban environment. To curb suburban sprawl in 2017, the Internal Revenue Service (SII) implemented land taxation on "non-agricultural" undeveloped land close to urban area to promote the compact city, limit new infrastructure and ensure the proper function of transportation system. However, the absence of mechanisms for proper assessment and

calculation of taxation led to the opposite results, in the search for regional lands to cover housing needs, skyrocketing the costs for new infrastructure.

In contrast to the regions of Latin America, in the United States, moving to the suburbs has become an "American dream" and not a solution of necessity. The late 1980s saw the movement of upper-class families into peri-urban zones in the rural landscape as well as large luxury housing estates creating upper-class residential clusters in the suburban area. The American model of urban crossing of the population and relocation from the anxious urban center, after its expansion in Latin America, later affected Asian cities and later European ones until it developed into a global problem.

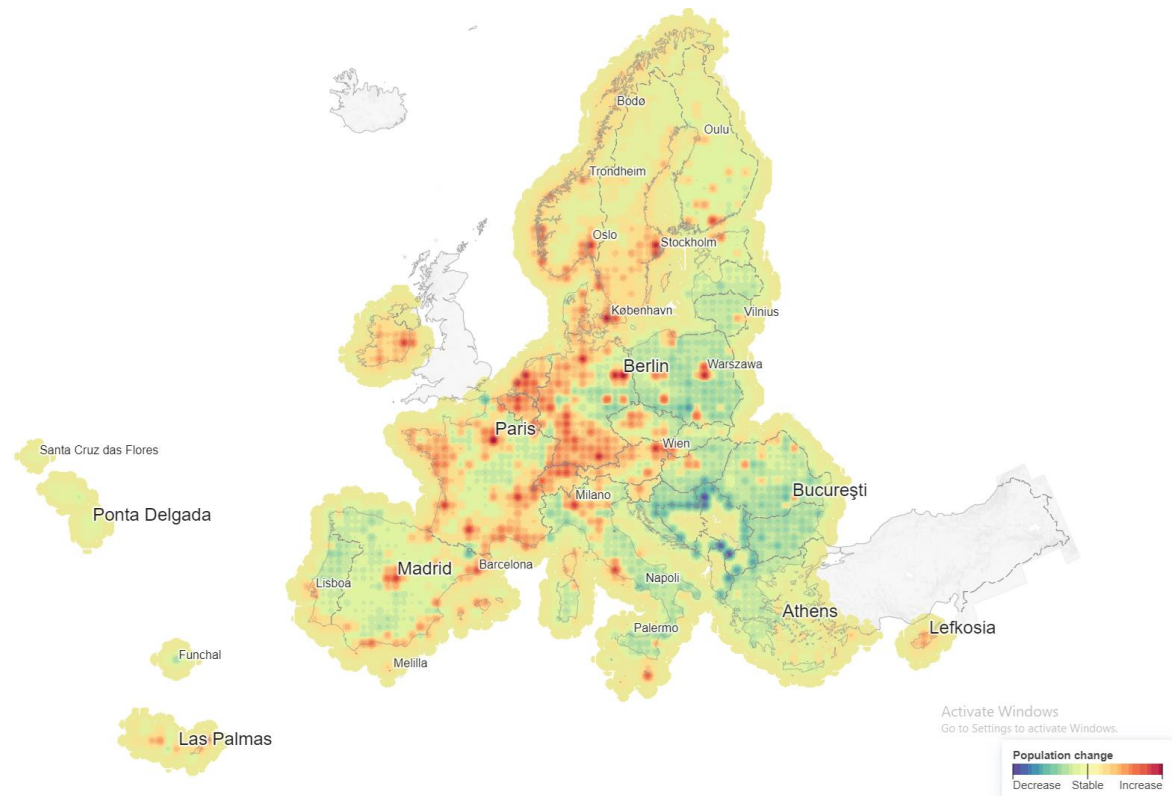
European cities seem to have initially tried to maintain the traditional urban core of the monocentric city, but after World War II, discord divided Europe into western and eastern parts. The traditional dense historic center until the collapse of communism in the late 1980s failed to survive. Eastern European countries relied on the compact city approach and development was limited to large building complexes. Such buildings accommodated the majority of the population that lived and worked in the cities and prevented the sprawl of residential areas. In contrast in Western Europe, different planning systems resulted in higher rates of urban sprawl. The problem of urban sprawl worsened in Europe shortly before 2000, creating significant shortages of natural resources, higher costs for service provision, and less desirable social cohesion. In addition to the concentration of sprawl along the road network and railway lines, like America's cities, there is also great sprawl in coastal areas, which attract large numbers of tourists and contribute to local economies.

The "EEA-FOEN report" results in 2016, before the start of the economic recession in Europe, recorded low levels of spread in the Scandinavian countries and inland Spain and high spread in the Benelux countries, West Germany, central and southern England and along the western Mediterranean coast. In parallel, the study showed that even regions in Central and Eastern Europe, which showed a decrease in their population, recorded an increase in urban sprawl resulting in the depopulation of the city cores and the expansion of residential areas with single-family houses (European Environment Agency, 2016)

An interesting example is the case of Spain which received significant construction pressures due to tourism and demand for holiday homes until it reached the peak of the real estate

cycle in 2009 (Morollón, 2016). The Madrid metropolitan area went through a phase of intense urban expansion until 2000 when the area of urban land increased at a rate of more than 4% per year (Díaz-Pacheco & García-Palomares, 2014). The phenomenon is most pronounced in medium-sized cities, where extensive urban sprawl has led to significant difficulties in terms of connections, mobility, services and infrastructure (López, 2023). However, with the onset of the economic recession in 2009 urban land expansion declined sharply. Although the example of Spain is highly related to the case of Cyprus, such pressures for touristic and holiday homes are traditionally faced by the cities of Paphos and Famagusta and not as much in Limassol as the increased demand for housing by the local population does not leave much room for alternative housing.

Figure 1: Urban sprawl in Europe, 2011-2021 change



Source: <https://ec.europa.eu/eurostat/>

In Poland at the beginning of the 1990s, the transition of the economy to a free-market system due to structural changes led to an intensification of suburban migration emphasizing the need for control of market mechanisms and the challenges of free-market forces. In particular, after 2003, relaxed legislation resulted in half of the investments in Poland being

made in areas without local spatial plans and in a wave of corruption (Litynski, 2021). This example highlights the importance of local government policies and how they can mitigate or promote peri-urban pressures.

On the other hand, in China, especially since the first half of the 1990s, the need to attract workers and investors to support the needs of urban production led to the introduction of policies to attract the population to cities. Increased demand for housing has resulted in rising property prices. However, government policies do not allow housing developers to hold inventory and require them to produce only as many housing units as they intend to sell. This has led to higher migration to medium-sized cities relative to megacities, which tend to increase property prices faster and to a greater extent than demand (Garriga, et al., 2021).

Different policies followed in different periods of time had different results. The policy of attracting labor to the cities causes a significant increase in house prices, creating a large gap between property prices and income, in contrast to the expansionary land policy which promotes a fall in the level of house prices.

2.3. Causes of urban sprawl

In most developed countries housing is the most important asset for most households, so governments are promoting measures to smooth the influence of business cycles on the housing market. A large number of studies and academic reviews have been carried out in order to analyze the phenomenon of urban sprawl and the conditions that cause it.

Population movement is due to house prices falling further away from the CBD to compensate for higher commuting costs. In such a monocentric city model, an increase in the urban population should increase the distance from the center to the boundaries and simultaneously increase the population density, as more people need to be housed. An increase in income raises housing demand and leads to lower population density while an increase in commuting costs reduces housing demand and leads to a more compact city with higher population density. Ultimately, the increase in agricultural land rent increases the opportunity cost of urban land and compacts the city (Oueslati, et al., 2015). Economic development has a direct effect on the shape of the city and on urban sprawl. Scholars have

divided the drivers and causes of urban sprawl into categories that include sociodemographic, economic, political, physical, environmental, and transportation causes.

The growth of the population and the need for housing are the number one factor for the beginning of the phenomenon of urban sprawl. However, population growth alone is not sufficient to result in urban sprawl. However, population growth is accompanied by economic growth, increased needs, changes in employment and new lifestyles that require more space. In the richest countries the area per capita has been calculated on average two to three times more than in the developing countries (Rubiera-Morollón & Garrido-Yserte, 2020).

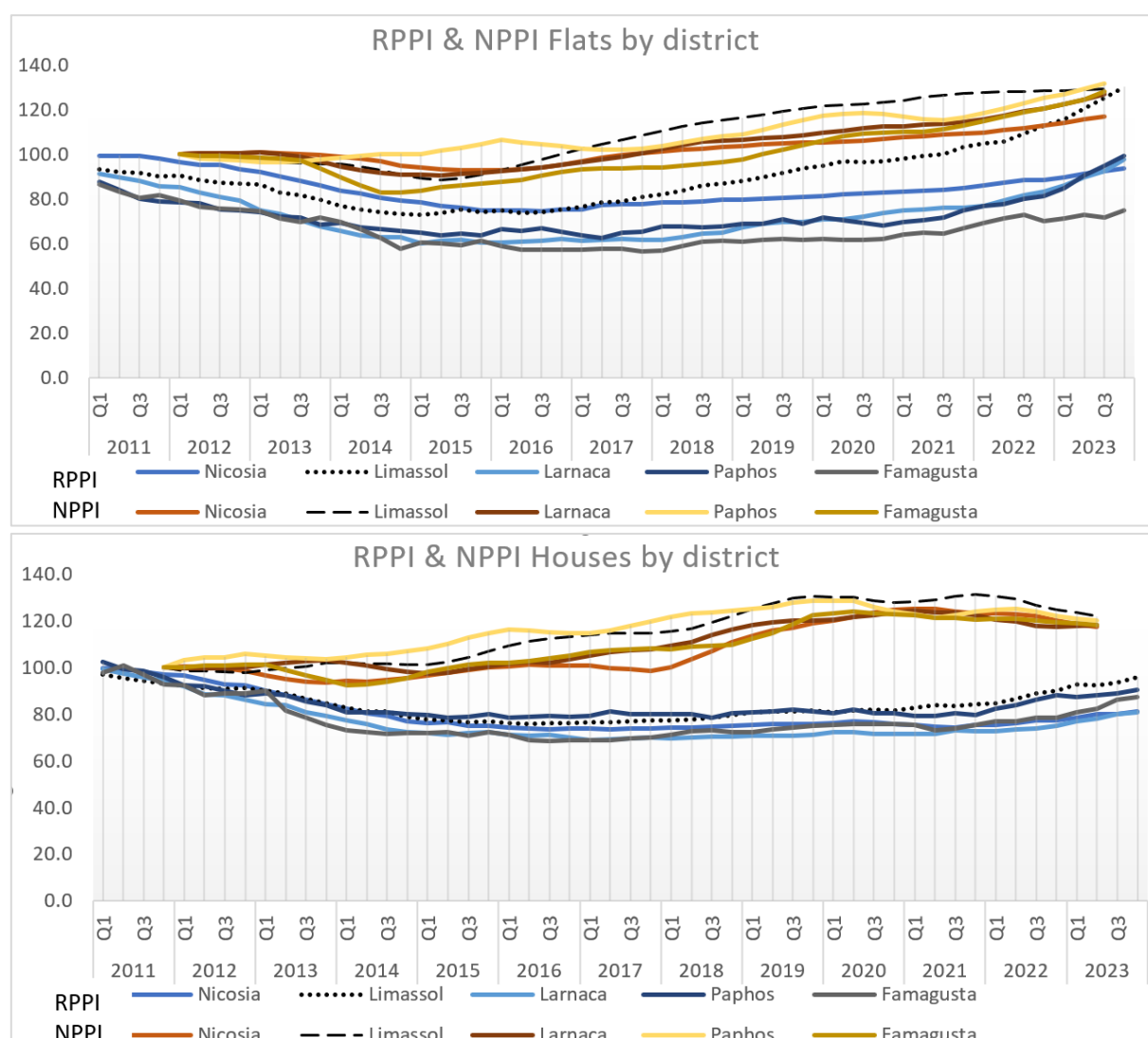
Economic growth is also one of the major causes of urban sprawl. Urban gentrification appeared in the early 1950s at the same time as the first phenomena of urban fragmentation. Rising incomes, out-migration of the working population and demand for housing lead to increased rents and property prices resulting in the displacement of low-income local residents and changes in the socio-economic character of the neighborhoods.

In Cyprus the increase in population is marked mainly by migration to the island. The annual inflow of population in recent years appears to have doubled. This is partly due to the wars that occur in the immediate geopolitical environment of the island, but mainly due to the importation of labor by the companies that relocate to Cyprus, especially to Limassol. In 2023 the total population of Cyprus was approximately at 0.9 million people. Based on Trading Economics macro models and analysis the population of Cyprus is expected to reach 0.93 million by the beginning of 2025.

Foreign activity patterns appear correlated with the continued inflow of foreign companies moving their operations and personnel to Cyprus because of the country's favorable tax environment, albeit at a slower pace in 2023 than in 2022. However, based on the CBC price index for the 3rd quarter of 2023, following the sharp rise in demand, property prices in Limassol recorded a significant increase of around 11% (Central Bank of Cyprus, 2024). The high cost of land and property within the city creates a situation where a large part of the population cannot afford (Oueslati, et al., 2015), and the low cost of property in peri-urban areas leads people, who cannot afford to buy a house in the city, to settle in the wider area, again leading to urban gentrification and sprawl (Wilhelmsson, et al., 2022). On the

contrary, the most recent data of the Neapolis Property Price Index shows signs of stabilization for house prices while apartment prices show a moderate increase with Limassol showing the smallest increase compared to the rest of the provinces, yet maintaining the highest prices in Cyprus.

Chart 1: Residential Property Price Index of CBC & Neapolis Property Price Index

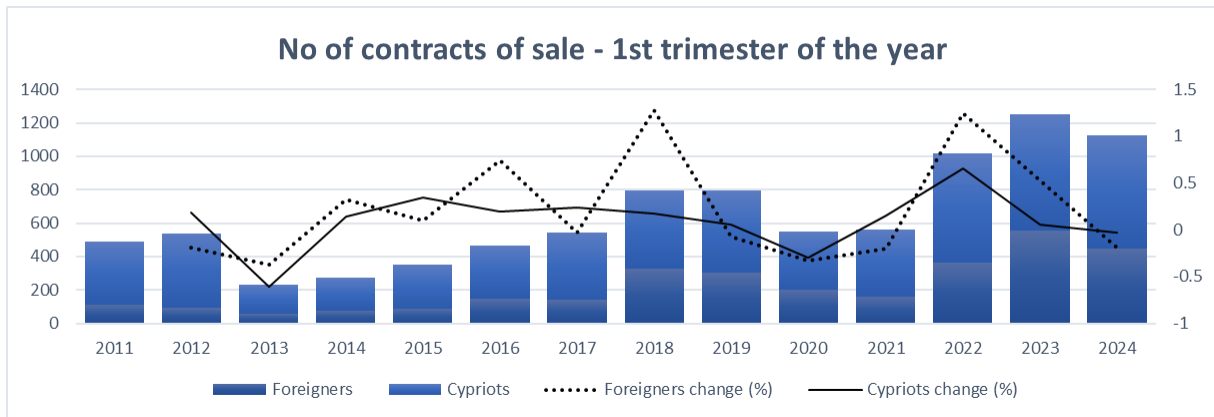


Source: Central Bank of Cyprus & Neapolis University, Developed for this report

Across Cyprus approximately 72% of properties acquired by foreigners in 2023 are for non-EU buyers, a significant increase from the 52% of properties acquired by non-EU buyers in 2022. Of these, 77% made their property investments in Limassol.

By examining the numbers of contracts of sales statistics, we can see that more and more purchases are being made by foreigners. In the initial quarter of 2023, contracts of sale by foreigners accounted for approximately half of total transactions. Similar to 2021 and 2022, a slight decline in the rate was noted during the first quarter of 2024, indicating the sensitivity of investments to adjacent geopolitical upheavals. In contrast to contracts of sale from locals, the quantity of contracts of sale from foreigners is still fairly high.

Chart 2: Number of contracts of sale during the 1st trimester of the year



Source: DLS Portal, Developed for this report

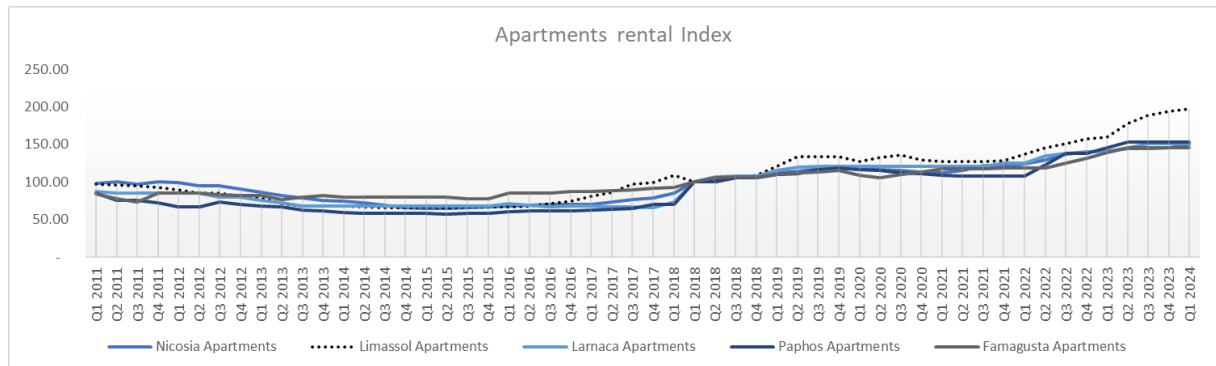
Moreover, the increase in construction costs by 30%, the increase in inflation, and interest rates on housing loans have further deviated the choice of purchasing a residence, with the result that the rental market dominates, with Cyprus recording one of the highest rental yields in Europe.

According to data from Danos International Property Consultants and Valuers, renting a one-bedroom apartment in Limassol costs at least 850 euros per month in a non-central area, while the cheapest two-bedroom apartment rents for 1,300 euros per month. A three-bedroom apartment rents for around 1,700 – 2,500 euros per month. It is estimated that the cost of living in Limassol is around 3,000 euros without rent (Buglo, Cost of living in Cyprus: a detailed guide for expats).

The Statistical Service reports that the average salary was 2,424 euros in the first quarter of 2024. The average salary over the last three years has been approximately 2,300 euros. However, the same source indicates that in 2022, nearly 20% of the population earned less than 1000 euros gross, and approximately 65% of the population earned less than 2,000 euros

gross, during a year when inflation was close to 11%. The seasonally adjusted average gross monthly earnings of Cypriots were 2,388 euros for the fourth quarter of 2023, from 2,257 euros the same quarter of the previous year. This represents an increase of 5% year on year. Continuing with data from the Statistical Service, it is stated that approximately 50% of employees earn an average salary of 1,500 euros, while the minimum monthly salary in Cyprus is set at 1,000 euros.

Chart 3: Apartment rental Index

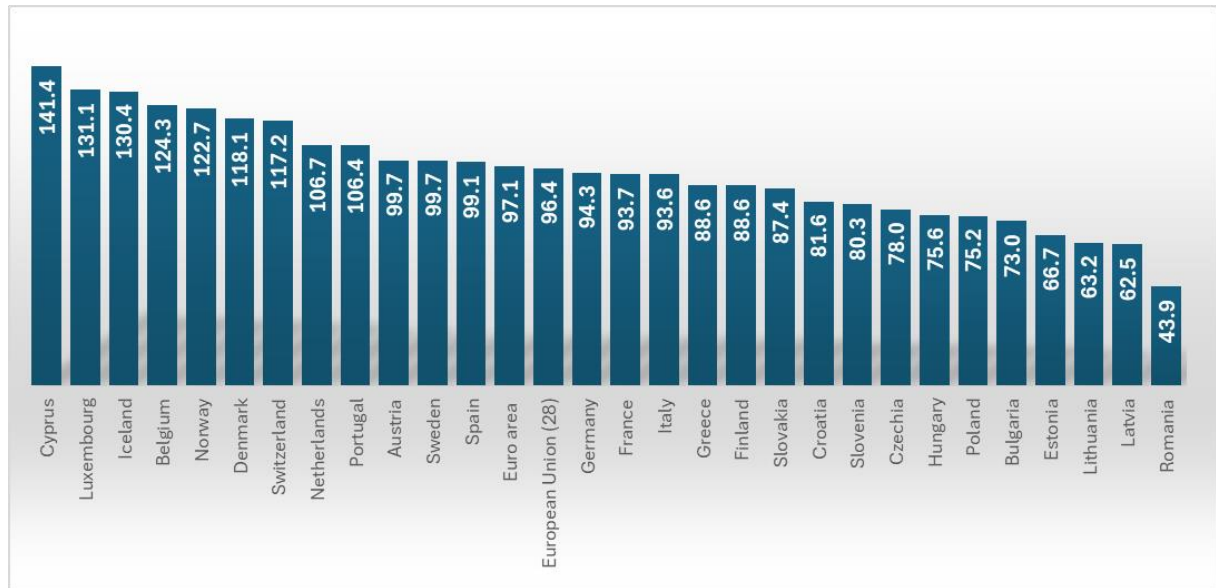


Source: ASK WIRE INDEX, Developed for this report

Based on the above data, we observe the imbalance created in the market by the combination of a workforce with high salaries and powerful investors in relation to the local population with much lower salaries who are struggling to cope with the new living conditions in the city of Limassol. Although the statistics show a general development, it seems that there is all up or all down, without a median.

From a socio-economic point of view, it is the demand for housing that essentially influences the growth of urban sprawl. The need for housing based on the financial capacity of each household leads to more affordable solutions in the peri-urban area. At the same time, among the causes is also identified the preference of people to live in suburbs (Seyyed & Mehran, 2018), with the realization of the American dream of a detached house with a garden leading to scattered construction in green and protection planning zones. Cyprus holds the first place in the average size of houses in Europe. On average, the size of a house is 141 sq.m., approximately 8% higher than the second ranked country, Luxembourg.

Chart 4: Average size of dwelling

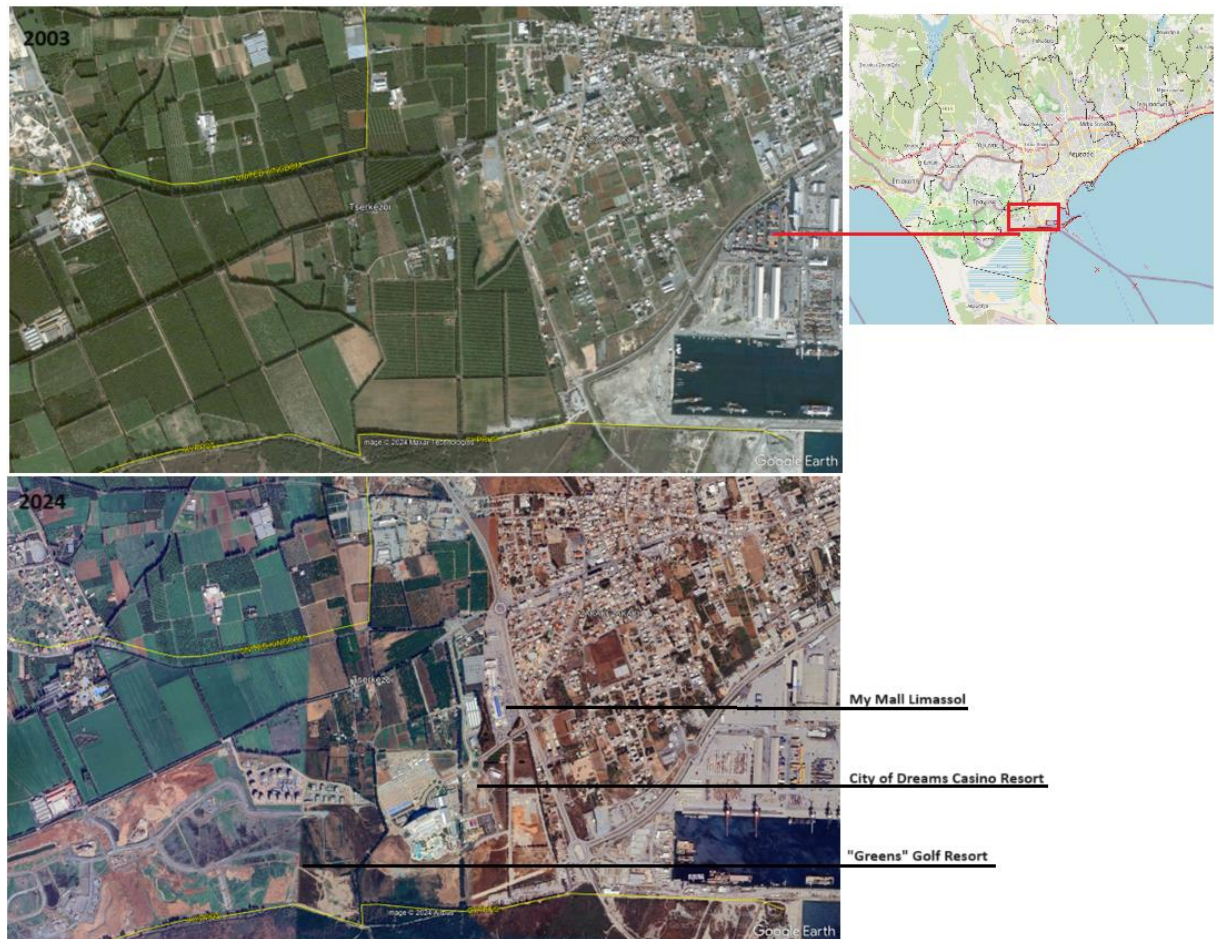


Source: Cyprus Statistical Service, Developed for this report

Nevertheless, political factors and policies are among the most important aspects of the urban development process. Urban sprawl is reinforced by the absence of strong planning intervention at the regional and local level as we already have in various examples above. Government policies during a period of economic growth determine whether the city will experience urban sprawl or maintain its compact form. Urban sprawl occurs when urban planning is not done properly, highlighting the need for government spatial planning policy to maintain urban standards, open spaces and environmental quality (Rosni & Noor, 2016).

A typical example is the case of Indonesia, where the expansion of cities due to excessive urbanization and low population density, led to the conversion of agricultural land, mainly due to its low prices, into residential land (Surya, et al., 2021). The city of Limassol is experiencing the same phenomenon. Before the developments pushed into agricultural land, the city had reached its limit. A recent example is the construction of the “City of Dreama Casino” and Greens Golf Resort”, which were built on former pure farmland and drew massive housing developments all around them. Large tracts of land, mostly planted with citrus trees, had to be removed as a result and when the government "strategically" gave permits to such developments.

Figure 2: Commercial & Residential Developments in agricultural land



Accordingly, market and banking system volatility such as taxation, inflation and interest rates have been widely correlated with housing price change (Li & Wei, 2020). Favorable tax incentives, such as subsidies and tax breaks, can encourage investment in housing and further increase the boom in house prices. In contrast, an increase in inflation and interest rates leads to purchasing difficulties and a search for more economical housing solutions in areas with lower land prices. In the US from 1999 to 2007, before the financial crash, household mortgage debt doubled in real terms to nearly \$11 trillion, more than the entire US public debt. At the beginning of the housing crisis, in 2009 the ratio of housing debt to GDP was 64.5%. In Europe even higher percentages were recorded as the ratio of housing debt to GDP in the Netherlands reached 111%, 89.7% in Denmark and 72.5% in the United Kingdom (Bueno-Suárez & Coq-Huelva, 2020).

Similarly, there is a tremendous increase in inflation in Cyprus, which is closely linked to the escalating war in the Middle East between Hamas and Israel, and is expected to continue as tensions persist in the island's immediate geopolitical environment. The ongoing conflicts in the Middle East have serious negative short-term and long-term effects on economic performance in neighboring regions starting with a 10% rise in oil prices which causes higher inflation, lower consumption and less investment. On the other hand, and at the same time, the war in Ukraine has caused various indirect effects on the economy of Cyprus, mainly through its effects on global markets and geopolitical tensions. As a transit country for natural gas pipelines supplying Europe from Russia, Ukraine could cut off natural gas supplies, leading to even more dramatic price increases for the island, which is entirely dependent on imported energy resources, resulting in continued increases in costs and in construction. Cyprus dropped from 27th place in 2022 to 28th place in 2023 according to the Global Innovation Index.

Cyprus's economy grew 1.2% on a quarterly basis in the first quarter of 2024, after growing by 1% the previous quarter. Cyprus's GDP Growth Rate reached an all-time high of 7.00 percent in the third quarter of 2020, after averaging 0.76 percent from 1995 to 2024. By the end of this quarter, the GDP Growth Rate in Cyprus is anticipated to be 0.70 percent and approximately 0.40 percent in 2025 based on projections from Trading Economics macro models and analysts.

The Consumer Price Index (CPI) dropped from 117.84 points in May 2024 to 117.72 points in June. Cyprus's Consumer Price Index (CPI) reached an all-time high of 117.97 points in October 2023, with an average of 52.17 points from 1950 to 2024. In June 2024, the annual inflation rate in Cyprus increased slightly from 2.7% to 2.9%, marking the highest level in eight months. Prices increased further for food and non-alcoholic beverages (2.91 percent vs 1.48 percent), housing and utilities (5.9 percent vs 2.9 percent in May), and communication (0.7 percent vs 0.6 percent). In contrast, costs for furniture, home supplies, and equipment decreased more slowly (-0.2 percent vs -0.3 percent). Alcohol and tobacco (1.3 percent vs. 1.4 percent), apparel and footwear (0.2 percent vs. 0.6 percent), health (1 percent vs. 1.3 percent), transportation (4.3 percent vs. 5.4 percent), leisure and culture (0.7 percent vs. 2.1 percent), dining establishments and lodging (5.2 percent vs. 6 percent), and other goods and

services (2.4 percent vs. 3.9 percent) saw a decrease in inflation during this time. June saw a 0.1 percent monthly decline in consumer prices, which was the opposite of the 0.6 percent increase seen in May. Cyprus's transportation sub-index of the CPI basket dropped from 119.92 points in May 2024 to 117.88 points in June 2024. The CPI for transportation in Cyprus was 102.89 points on average between 2015 and 2024 and reached all-time high of 129.84 points in July 2022, almost two years ago. This indicates that there are economic issues arising from increased interregional transportation.

Because of the government's compensatory measures, increased employment and wages for the majority of the population, and other factors, consumption rates do not appear to be affected even after the sharp rise in interest rates and inflation.

Speculation is also mentioned in many articles as an important factor in urban fragmentation, as private individuals or even governmental agencies buy land in suburban areas at extremely low prices in order to obtain higher returns on the land in the future (Sinha, 2018).

2.4. Effects of urban sprawl

In many bibliographic references, urban sprawl is presented as a contemporary positive phenomenon that helps control land prices, regulates housing values in the city center, prevents urban congestion and improves the quality of life as well as the development of land uses, population expansion and physical development. However not all cities are able to control rapid urban growth leading to social, political, economic, cultural and environmental consequences. The majority of studies agree that sprawl has significant negative consequences for the functioning of the urban core, health and the environment. It increases dependence on the car because its form supports a greater dispersion of activities and makes it necessary to spend more time traveling between activities.

The future of urban centers appears to be threatened by the significant effects of urban sprawl on the economy, government, biodiversity and the environment. Research has shown that urban sprawl is the main cause of land fragmentation, depletion of raw materials and natural resources from overbuilding, loss of agricultural labor, destruction of habitats and wildlife species, environmental pollution, and global warming (Ibimilua , et al., 2020).

The new residential developments resulting from urban sprawl are built on land converted from agricultural to residential. Particularly in cases where the primary sector is experiencing a contraction, landowners are deciding whether to sell their farms to developers (Magliocca, et al., 2015). Especially in suburban areas where land is initially cheap and transportation to the urban center is easy, usually in agricultural areas close to the highway, developers are attracted and urban sprawl is encouraged. These exchanges of farmland and the reduction of agricultural land cause the degradation of water quality, loss of wildlife and habitats, discouragement of agricultural production and loss of natural landscape. Along with suburban development, changes in land use regulations are becoming necessary, leading to rapid increases in real estate prices (Cocheci & Petrisor, 2023).

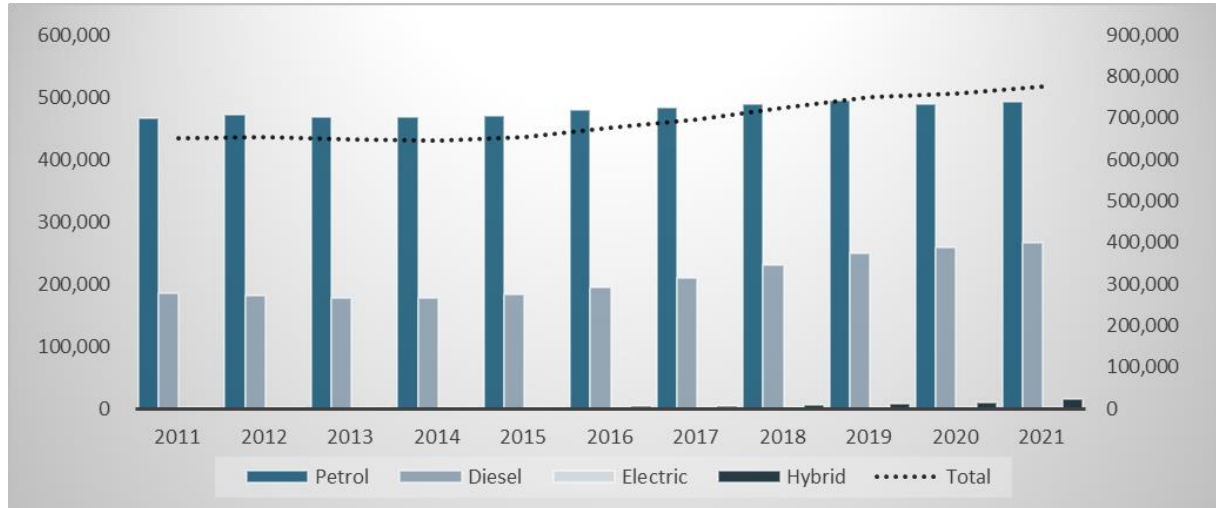
Figure 3: Scattered single-family housing within a Protection/ Agricultural Planning Zone – Ypsonas area



The reduction of green spaces and vegetation along with car dependence link urban sprawl to energy and climate change issues, as well as air pollution resulting from increased car use while at the same time increasing accidents on the highway, posing a greater risk to human health (Young, et al., 2016). Urban sprawl leads to increasing levels of local traffic congestion and the elimination of urban open spaces to complete dependence on cars and limit the use of "physical mobility" contrary to the principles of sustainable mobility. Migration to the peri-urban space and dispersion of activities increases the dependence on the car for daily commuting. In a 2003 study in the United States, estimated the value of lost time and wasted fuel due to delays and traffic congestion, with annual cost of congestion at

\$63 billion. It is emphasized that although congestion is a major factor in urban sprawl, it is also caused by it.

Chart 5: Licensed vehicles by energy type, 2011-2021



Source: Cyprus Statistical Service, Developed for this report

In Cyprus, dependence on the private vehicle is rampant. The majority of the population uses private vehicles to cover distances that are not served by the public transportation. This is highlighted by the increasing registration of private vehicles. During the first six months of 2024, the total registrations of motor vehicles increased by 19,2% compared to the corresponding period in 2023. This situation is even more alarming considering that approximately 30% of the total number of registered cars are diesel-powered, which additionally burdens the environment with gaseous pollutants.

The increased built environment in suburban areas, both with houses and infrastructure, damages ecosystems, resulting in detrimental effects like extreme traffic jams, pollution, unsustainable land development, fewer public parks and spaces, and more strain on infrastructure. Therefore, pollution and the loss of green spaces, farmland, and native vegetation will probably cause health issues for the people living in the greater Limassol area. With the current trajectory of urban sprawl, Limassol is off track to achieve SDG 11 (which aims to make cities and human settlements inclusive, safe, resilient and sustainable) by the year 2030. Based on SDG 11, unplanned urban sprawl makes cities more vulnerable to disasters. SDG Target 11.1 aims to achieve access for all to adequate, safe and affordable housing and basic service, and upgrade slums by 2030. Affordability concerns are the

primary driver of acquiring a suburban home, as explored in this study on the causes of urban sprawl in Limassol, indicating that the initial target is not met.

Likewise, the increase in urban population and built-up area collectively puts pressure on infrastructure and facilities such as water, energy, roads, schools and healthcare. These are among the social impacts of urban sprawl causing unequal distribution and accessibility. For instance, the increase in the number of students per teacher (Cocheci & Petrisor, 2023). Such conditions limit the achievement of Target 11.3 which refers to strengthening inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.

Figure 4: Land use changes in Kolossi-Ypsonas area



Based on the study by Radu-Matei Cocheci and Alexandru-Ionut Petrisor (2023), the degradation of natural habitats with the loss of land covered by natural vegetation and the water pollution from residential sources as the increase in sewage increases (Cocheci & Petrisor, 2023) are among the main consequences of urban sprawl. This is related to and contrasts with Target 11.6, which aims to reduce the per capita adverse environmental impacts of cities, among other things by paying particular attention to air quality and the

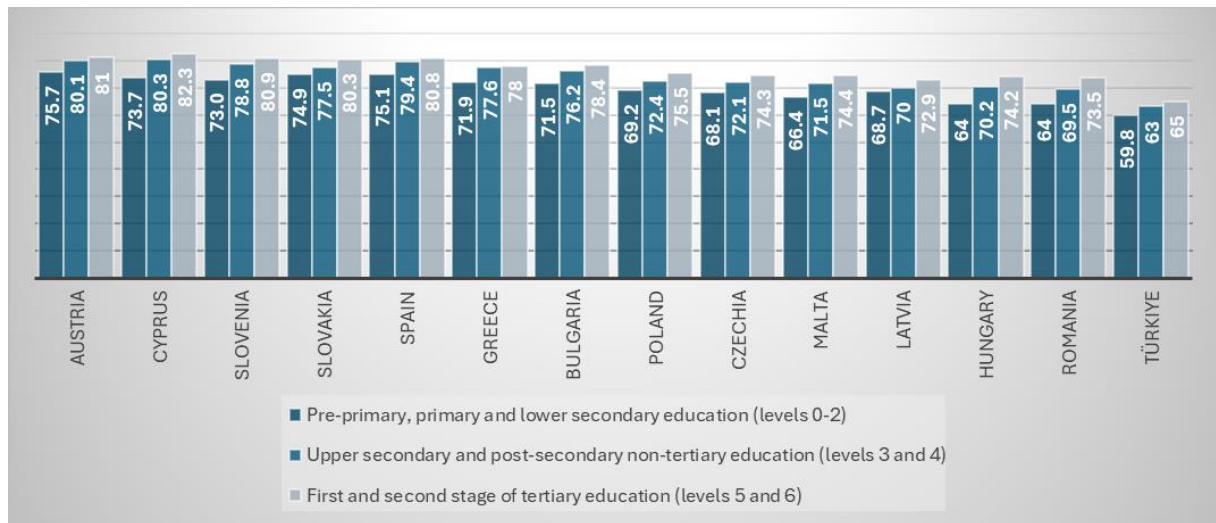
management of municipal and other waste, by 2030. In Limassol, the increase in urban sprawl has led to a degradation of air quality due to increased emissions from cars and infrastructure construction while the operation of a unified sewage system has not yet been achieved in the modern infrastructure of the city. Target 11.6 and SDG 6, which deal with universal access to clean water and sanitation, are closely related because water resources cannot be preserved without efficient urban planning and waste management practices (Ranjan, et al., 2022). Additional environmental impacts such as the urban thermal environment, increased urban heat island effect and land surface temperature, (Bhumika , et al., 2023) reduced regional open space, increased stormwater runoff, and increased flood risk (Johnson, 2001) have been linked with urban sprawl due to the limitation of vegetation and green areas. This is the concept of SDG 13 “Combat Climate Change” as natural disasters and climate change are a particular threat to cities.

The sprawling city model has already been indirectly linked to significant health problems affecting the population that experiences it. Total dependence on the car reduces physical activity and is likely to lead to an increase in obesity with subsequent health consequences such as higher mortality rates and various diseases (Hamidi, et al., 2018). Studies have shown that reduced levels of physical activity resulted from residential sprawl could be responsible for obesity (Lopez, 2004). Health issues are the aim of SDG 3 which promotes healthy life for all. Cities and infrastructure contribute to public health and well-being and are closely linked to the environment, poverty, and health. It is complemented by Target 11.2 on compact cities with improved road safety, in particular by expanding public transport. Road safety, health, and cities are inextricably linked, as living conditions affect health in many ways.

Low-density neighborhoods, poor street patterns, lack of pedestrian amenities, and inaccessible destinations are characteristics of sprawling development that discourage physical activity leading to obesity and thus heart diseases, high blood pressure, diabetes, and different types of cancer (Yan, et al., 2021). These unfavorable development conditions also affect the health of children, in whom reduced physical activity and a degraded environment contribute to obesity, hypertension, and various psychosocial disorders (Wu & al, 2021). Conversely, a compact urban form with provisions for urban sustainable mobility

can reduce cardiovascular mortality. According to Hamidi et al (2018) in the United States, the county compactness index had a direct positive correlation with life expectancy. Beyond reduced physical activity, sprawling suburban development shows reduced air quality and air pollution that can increase oxidative stress and systemic inflammatory diseases in humans, directly contributing to depression and cognitive dysfunction and even causing brain damage and dementia.

Chart 6: Psychological distress by educational attainment level (average score) in Europe

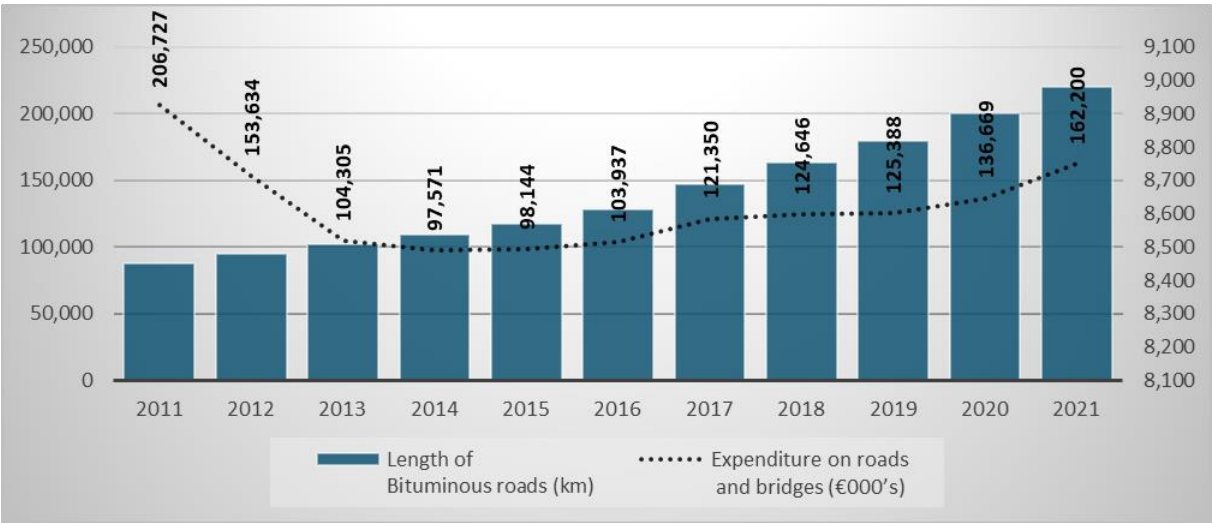


Source: Cyprus Statistical Service, Developed for this report

Urban sprawl has been considered to additionally affect local fiscal stability and the local economy as it is generally found to increase the duration of local government debt and, in the medium and long term, lead to a greater tax burden. The longer and costly distances created by lower population density require the expansion of the road network and hinder the success of mass transit by increasing infrastructure costs in large urban and peri-urban areas. This means that population growth has put additional pressure on the government's financial resources to serve the growing population (Ashraf, et al., 2022). In reality, however, this cost is passed on to the population as infrastructure expansion increases taxation and consequently costs. At the same time, increased health problems and obesity lead to increased costs in the health care sector. Greater consumption of resources to expand infrastructure and erect sparsely populated single-family homes leads to greater environmental damage. The spread inevitably leads to higher demands and consumption of fossil fuels, mainly in the transport sector resulting in the release of carbon dioxide, an

important greenhouse gas that has been linked to global warming (Gargiulo, et al., 2012). Air pollution created by traffic again threatens human health, agricultural production, and ecological systems.

Chart 7: Length of Public Roads and Total Expenditure an Roads and Bridges, 2011-2021



Source: Cyprus Statistical Service, Developed for this report

In addition to the above, and the significant health and environmental impacts, sprawling cities have reduced policing that tends to accompany population concentrations, along with factors such as community cohesion, density and increased mobility resulting in higher crime rates. Meanwhile, social conflicts are increasing in the cities due to the coexistence of different social classes and the creation of extremely dangerous ghettos in the urban centers (Rubiera-Morollón & Garrido-Yserte, 2020).

3. Methodology

3.1. Data Collection and analysis

Based on the previous analysis we saw that the increased real estate prices in a society where wages and economic growth do not move at the same rates, in combination with increased housing needs, lead to urban sprawl. Urban fragmentation, however, is directly linked to the degradation of the quality of the environment by reducing agricultural land and green spaces and increasing the built environment with roads and housing, expanding infrastructure, reliance on private vehicles and intensifying gas emissions.

We examined the phenomenon of urban sprawl that has been strongly recorded in recent years and how this exerts significant pressure on the environment and is an obstacle to the achievement of sustainable development as well as its multidimensional environmental, economic and ecological impacts (Jaeger, et al., 2022).

After analyzing the phenomenon of urban sprawl and its relationship with sustainable development, identifying the market mechanisms that cause urban sprawl in Limassol as well as how they affect and are affected by the various, politics and economic conditions, we focus on visualizing the urban sprawl in Limassol. Visualizing the phenomenon will initially contribute to its recognition. To face a problem, we must first realize that it exists and identify the changes it causes in the study area.

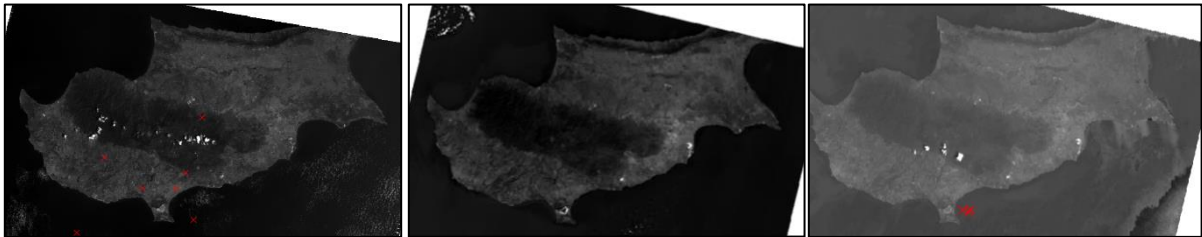
Remote sensing and geographic information systems (GIS) methods are a contemporary tool for monitoring and evaluating urban sprawl that are used worldwide by urban planners and researchers to identify urban sprawl. Using various multidimensional indicators and descriptive statistical analysis a better understanding of urban expansion and issues related to cities is achieved based on spatial and temporal patterns of land cover. (Abedini, et al., 2020). The use of remote sensing applications in the monitoring of urban areas offers advantages such as the integration of multiple sensor data, fast data acquisition, real digital data processing and efficient analysis and provides accurate and permanent recording of spatial data and processes (Krishnaveni & Anilkumar, 2020).

For instance, Wang J., Mok D. and Sun X. (2021) by analyzing aerial photographs showed, on the contrary of most researchers, that increases in property prices reduce urban sprawl. With the use of satellite data, the influence of urban sprawl in the city (Ehrlich, et al., 2017) of Limassol is clarified and the diversity of the urban area is identified. By using satellite images in different periods of time, we can observe the expansion of the built environment in areas that were once agricultural. In this way, an analysis is made of the urban crossing and the change of land uses, the conversion of peri-urban arable land into residential land (Bourennane & Kubicek, 2022)

In Cyprus the survey has rarely been used to measure urban sprawl and even more rarely by public services to address urban planning and real estate issues. The present research attempts to apply remote sensing techniques to investigate the dynamic changes of the urban sprawl phenomenon.

To track dynamic changes in the urban sprawl of the study area, Limassol province, built-up areas were extracted from classified Landsat images of three distinct periods in order to be compared. The first period according to the previous census in 2011, the second according to the most recent census of 2011 and the third in 2024, during the implementation period of the present study for updated results. Satellite images are freely provided online by the U.S. Geological Survey (USGS).

Figure 5: Satellite images from USGS



Source: USGS

The **Table 1** lists the acquisition dates and sensors for the selected satellite images. Landsat Thematic Mapper (TM) data were adopted as the basis for image analysis and land cover classification for the years 2011, 2021, 2024 with satellite images taken during the same time period, during the summer months, resulting in limiting the perambulations in satellite images from weather constraints.

Table 1: Landsat Characteristics

ID	Path/Row	Data Set	Acquired date	Cell size	Band List	Land Cloud Cover
LT51760362011194MTI01	176/36	Landsat 5 TM	13/07/2011	30	1 2 3 4 5 7	1
LC81760362021157LGN00	176/36	LANDSAT 8 OLI/TIRS	6/6/2021	30	2 3 4 5 6 7	0.14
LC91760362024158LGN00	176/36	LANDSAT 9 OLI/TIRS	6/6/2024	30	1 2 3 4 5 6 7	0.23

Source: USGS, Developed for this report

Using the Semi-Automatic Classification Plugin in QGIS, we added the 7 Landsat Bands, of each satellite picture. With the Bands of each satellite picture, we created a Band-Set (SCP) and we used the band combination 4-3-2 which is red -green -blue for Landsat to generate a true color composite image. Based on the color image we created some regions of interest for two Micro Class IDs, Built-up area and non-Built-up area, giving labels to the program to determine the land cover classifications and create an algorithm using supervised class inputs.

For the purposes of this study, we consider the residential area as an indicator of urban sprawl. Therefore, an increase in Built-up area and an increase in the number of cells in Micro Class: Built-up area, are translated as an increase in urban sprawl. Based on the configuration and composition of the satellite images collected in three different time periods, we interpreted the spatial geometry of Limassol.

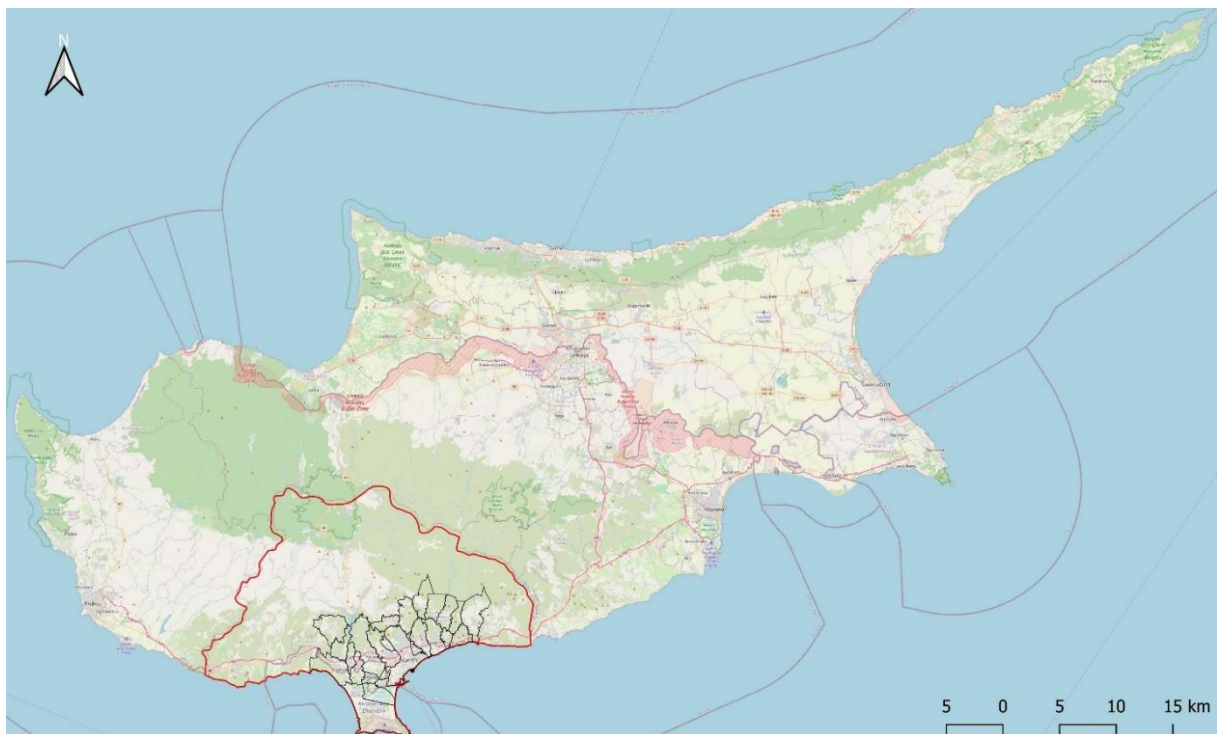
In order to achieve the objectives of the study, it is necessary to have available and timely information on urban expansion such as population growth, house number increase, density and real estate prices which are the main parameters for this study collected by the Cyprus Statistical Service, Eurostat Central Bank of Cyprus and the Department of Land and Surveys

Generally, in the present study, data collection was done from both primary and secondary data sources. The primary data collected were multispectral satellite images. The secondary data collected include demographic and economic data from the Cyprus Statistical Service and Eurostat and sales statistics from the Department of Land and Surveys. Furthermore, in our analysis data from different real estate price indices are used to compare the increase in prices over time and in each individual area, in the wider area of Limassol, in relation to the

increase in population, income as well as the percentage of houses that are bought by foreigners in order to show the relationship between prices and affordability. An important part of the data we analyze includes the area of urban and peri-urban communities to calculate population density within and close to the city center. We aim to estimate the urban sprawl phenomenon in Limassol by examining the behavior of population and house prices during the last two censuses, between the selected municipalities close to the city of Limassol, as examined in the case of China (Garriga, et al., 2021).

The analysis will include the new areas from the recent local government reform as well as bordering areas which have empirically been judged to receive a large influx of population and have faced with extensive residential developments.

Figure 6: Map of examined area



Finally, based on our analysis and the data collected we propose ways to maximize the use of the urban area to represent the needs of citizens of all economic classes, the rational operation of sustainable models (Asadi & Habibi, 2011) as well as control mechanisms of urban sprawl (Xiaoxiao, et al., 2020) of real estate prices.

3.2. Validation

The process of image classification is limited by challenges observed when pixel-based approaches are applied to heterogeneous regions where surface features such as color, structure, and texture play an important role. Typically, this limitation occurs when the object size is much smaller than the pixel size. The study area showed such observations as it appears that the angle of incidence of sunlight has great potential to differentiate the spectral reflectance pattern of similar signatures (Karma & Komal , 2022). The photographic interpretation of the satellite images taken seems that the salt marsh that exists in Limassol due to its color, in the summer months when there is a drought, has a similar spectral signature to the built environment.

Additionally, in the satellite image taken on 06.06.2024, clouds above the Limassol district also exhibit a spectral signature similar to the built environment, resulting in lower accuracy compared to the other satellite images.

3.3. Limitations

Although we cannot quantify the effects of urban sprawl related to environmental and human health impacts, we can observe the increase in construction, road networks, the number of cars, and the decrease in agricultural land leading to increased emissions and burden human health.

The lack of data in Cyprus, particularly at the local level, remains a significant issue. In Cyprus, there is a limitation and stagnation in the sharing of statistical data, whereas most developed countries have comprehensive land cover information. Due to the lack of data at the local and quarter level, it was not possible to analyze the effects of urban sprawl within the Limassol district.

4. The case of Limassol

4.1. Cyprus economy overview

Cyprus is strategically located in the Eastern Mediterranean. It is an important hub of maritime routes of strategic control of the wider geopolitical area, which constitute simultaneously economic and cultural communication routes with Europe, Asia and Africa. Therefore, we can refer to a strategic and economic surplus for the island. The rapid urbanization, demographic change, competing political and economic interests, and diversity of cultural patterns have had a significant impact on real estate in the island. According to the 2016 National Report of Habitat III, there exist two medium-sized urban agglomerations in Cyprus, namely Nicosia and Limassol, and two smaller ones, namely Larnaca and Paphos.

The tertiary sector accounts for over four-fifths of the GDP in Cyprus, and it is the foundation of the country's economy. Since the Turkish invasion, the main drivers of development in Cyprus have been and continue to be tourism, banking, shipping, and real estate. The Ministry of Finance's "Outlook 2023-25" states that the Cyprus's economy primary focus for the years 2023–2025 will be on the housing market and individual consumption. It is anticipated that fixed capital investments will lead to economic expansion. Better recovery prospects are provided by the EU's Recovery and Resilience Plan (2021–2025), which calls for large capital investments and strengthening the economy's foundation. From 1377.30 EUR million in the fourth quarter of 2023 to 1386.30 EUR million in the first quarter of 2024, Cyprus's GDP was driven by services. Cyprus's GDP from services reached an all-time high of 1386.30 EUR million in the first quarter of 2024, with an average of 928.84 EUR million from 1995 to 2024.

Since 2014, and subsequent to the 'haircut' of Cyprus' economy, the growth of GDP has accelerated and exhibited an upward trend until the onset of the pandemic in 2020. During the pandemic, there was a large decrease caused by the lockdowns. However, by the end of the covid-19, the island's GDP had continued to grow at a slower pace, but it is expected to continue to grow.

Services, which include real estate, financial services, and tourism, account for 80% of Cyprus' GDP and are regarded as the cornerstones of the country's economy. Just 10% of the

pie is made up of industry, and just 2% is made up of the primary sector. When it comes to spending, household consumption dominates the GDP and makes up 70% of its total usage. Government spending comes in second with 16% and gross fixed capital formation comes in third with 1%. Products and services exports make up 55% of GDP, while imports make up 53% and add 2% to the overall GDP.

Despite the end of the CIP: The Cyprus Investment Program on 1 November 2020, and concerns about reduced demand amid the construction of huge residential developments, demand has not abated much. Nonetheless, the island's economic landscape clearly shows the effects of both the pandemic and the ongoing conflicts in Ukraine and the Middle East. Rising interest rates continue to have a negative impact on corporate investments and residential construction because they make it more difficult for buyers and developers to obtain loans. The two primary elements that will help to make up for the lost earnings from the pandemic are the anticipated levels of tourism and the exports of business services.

However, the expansion of the tertiary sector, as well as the influx of investments and relocation of international corporations, was not significantly affected by the effects of the pandemic. Global investors, attracted by the favorable tax system, create the majority of the demand and balance the market. The districts of Limassol and Paphos attract the most interested foreign investors, both from EU and non-EU countries. Limassol offers luxurious and lifestyle apartments in high-rise seafront towers to affluent foreign buyers.

4.2. Limassol's development

Limassol is the southernmost city in Cyprus and Europe and is located at the crossroads of three continents, Europe, Asia and Africa. It is the fourth largest province after Nicosia, Famagusta and Paphos. It borders Paphos District to the west, Nicosia District to the north and Larnaca District to the east. The District of Limassol extends on the southern coastal front of the island in a strip of area 25 Km² to the east and 35 Km² to the west of the city of Limassol, while to the northwest it extends to an area of 40 Km².

As a city, Limassol is the second largest in Cyprus with an area of 13,800 hectares and with a population that has shown an increasing trend in recent years. It is the continuation of the ancient civilizations of Amathus and Kourio, but despite traces of habitation from ancient

times, the contemporary city of Limassol is a remnant of the modern era. Despite the various historical declines and severe problems, the city has today managed to turn into a valuable tourist resort and a major business center, while it is now a modern city with important infrastructure and development projects.

The city is built on the basis of the "radial" model, with radial streets and peripheral rings, starting from the historic center, around the old port and the castle. The development of Limassol is significantly limited by the sea. It is a port city with the result that its development took place around the port and mainly to the west and east and along the coastline unlike the conventional monocentric city. The radial development model of Limassol in reality does not favor urban sprawl due to the fact that it is limited by the motorway around the city to the north and the sea to the south. However, population growth and housing needs managed to push development beyond the motorway border. Initially, the city extended along the coastal road eastward and northward to Independence Street (main shopping street). The rest of the areas between the radial roads developed later at a rather slow pace.

4.3. Limassol's Market Analysis

Both foreigners and locals drive Limassol's market, which includes a sizable demand for real estate properties of all kinds. In terms of the total transaction value, Limassol plays a significant role in the growth of the Cyprus real estate industry. Compared to other European nations, real estate investing is significantly more affordable in Cyprus. However, this is not reflected in the earnings of locals, particularly in Limassol.

In 2020, there was a sharp increase in the number of foreign purchasers, particularly for residential properties near coasts, which seemed to be of appeal to foreign buyers. The most expensive residential real estate is found in Limassol, where the market is dominated by Russian buyers who buy luxury rental homes, towers, luxury residential resorts, the "City of Dreams" casino, and new development projects like the Limassol Marina. The simplified, efficient and transparent tax system and the special exemptions and incentives for investments it offers combined with the geo-strategic location offered by the place are the

most important comparative advantages in this sector and the reason why many companies choose to relocate in Limassol.

The increasing number of high-tech and fintech companies choosing to relocate to Cyprus, accompanied by their highly paid workforce, has led to a huge increase in demand. Due to the low supply and inability to satisfy the rapidly growing demand, real estate prices have exceeded the economic scope of the locals. Employees of such companies typically prefer newer properties, mainly for rental. This leads to higher rents due to a tight supply, which takes them off the market for locals who cannot afford the adjusted prices (DANOS, 2023). This leads the locals to a search for smaller, older, and lower quality units in the city center, degrading their living condition or search for houses in sub urban areas.

A robust rental market was created for the purchase of rental properties and vacation homes as a result of the high cost of purchasing in Limassol, the recent increase in interest rates, and the rising levels of foreign demand related to relocations to Cyprus. Because Cyprus offers almost 7,5%, according to RICS INDEX, attractive return on investment, foreign investors—and not just those from other countries—who purchased their properties prior to market bubbles seized the chance to rent them out. Cyprus's home ownership rate dropped from 69.60% in 2022 to 68.80% in 2023. The home ownership rate averaged 71.66% from 2007 to 2023 meaning that it now below averages Cyprus's home ownership rate marked a record low of 67.90% In 2019, indicating that the current rate is almost at the lower record and highlighting the dominance of the rental market.

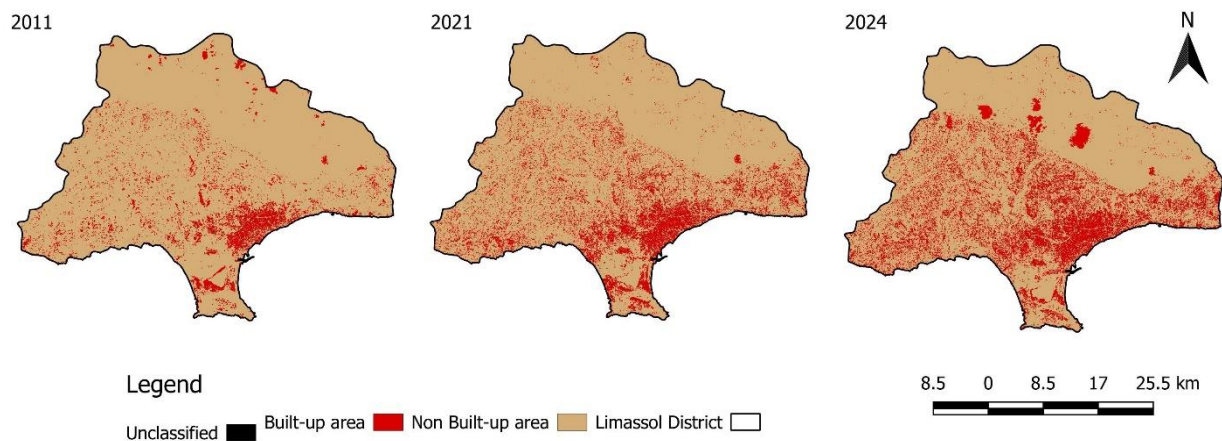
4.4. Remote Sensing and Geographic Information Systems

The urban sprawl of Limassol is shown in the Figure 7. Even though the city appeared to be growing eastward up to 2011 due to the concentration of high-end residential buildings and tourism, later satellite images from 2021 and 2024 show that the city is actually developing both north and west.

Increasing urban sprawl affects land cover, land typology and morphology, population mobility, and the demand for expanding road networks and infrastructure. The city of Limassol is already experiencing serious problems with traffic congestion and changes in the approach's spatial pattern as a result of the spread and associated effects. With the

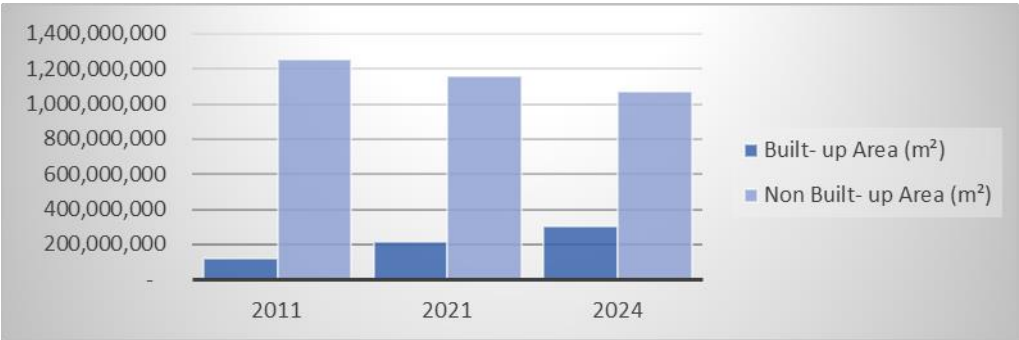
exception of the mountainous regions, based on the supervised classification of the satellite images, it appears that the population is growing out of control throughout the province's lowland and semi-mountainous regions.

Figure 7: Results of Semi-Automated Classification



The amount of non-built-up area has decreased in contrast to the built-up areas which have increased significantly as a result of inefficient land use. Despite the huge stock of growth factors within the city center, the population chooses to relocate to the peri-urban area where real estate prices are significantly lower. The small size of the island and the short distances for daily commuting combined with the lower real estate values are an incentive to buy a property in a non-urban area without limiting the possibility of work and entertainment in the urban area.

Chart 8: Micro Classes estimated area of Semi-Automated Classification



Source: Developed for this report

As we have found in the international development models, the formation of development on a local scale follows 2 patterns. It is observed either in linear development along main road arteries and coastline, or polycentric development around the activity hubs or the historical center of the city. Gradually in both types of growth, their density is gradually lost as the distance from the focal element increases.

Figure 8: Development along main road artery in Germasogeia area



The increase of the built-up area in peri-urban areas is immediately noticeable from the classification of satellite images. From 2011 to 2021 we observe that the area of the built-up area almost doubles while the annual growth has been calculated at 7.54%. From 2021 to 2024, the area of the built-up area increases at a faster rate, registering an annual growth rate of 13.84%, highlighting the intense housing pressure that the area under study is facing.

Table 2: Statistics of Semi-Automated Classification

	Built- up Area (m ²)	Non Built- up Area (m ²)	% Built- up Area	Annual growth (%)	Mean	St.Dev	SS
2011	121,536,000	1,250,326,800	8.86%	-	1.911	0.284	123,077
2021	213,121,800	1,158,741,000	15.54%	7.54%	1.845	0.362	200,014
2024	301,578,300	1,070,284,500	21.98%	13.84%	1.780	0.414	261,424

As we continue our analysis, the standard deviation in all 3 samples is around 30-40% showing high points of variation and explaining to what extent the sample correlation of the supervised classification is scattered around the mean which is around 1.8.

The normal sampling distribution appears as a "bell curve" and is symmetric about the mean. The samples obtained in the 2011 analysis are closer to the mean, standard deviation 28%, and appear more frequently than the data far from the mean. The samples in the 2021 analysis show a standard deviation of 36% while the samples in the 2024 analysis record an even higher standard deviation of 41%, meaning that the sample is more prone to volatility. At each subsequent classification, the Sum of Squares (SS) increases indicating that the deviation of the data is increasing further away from the mean

4.5. Population and sprawl

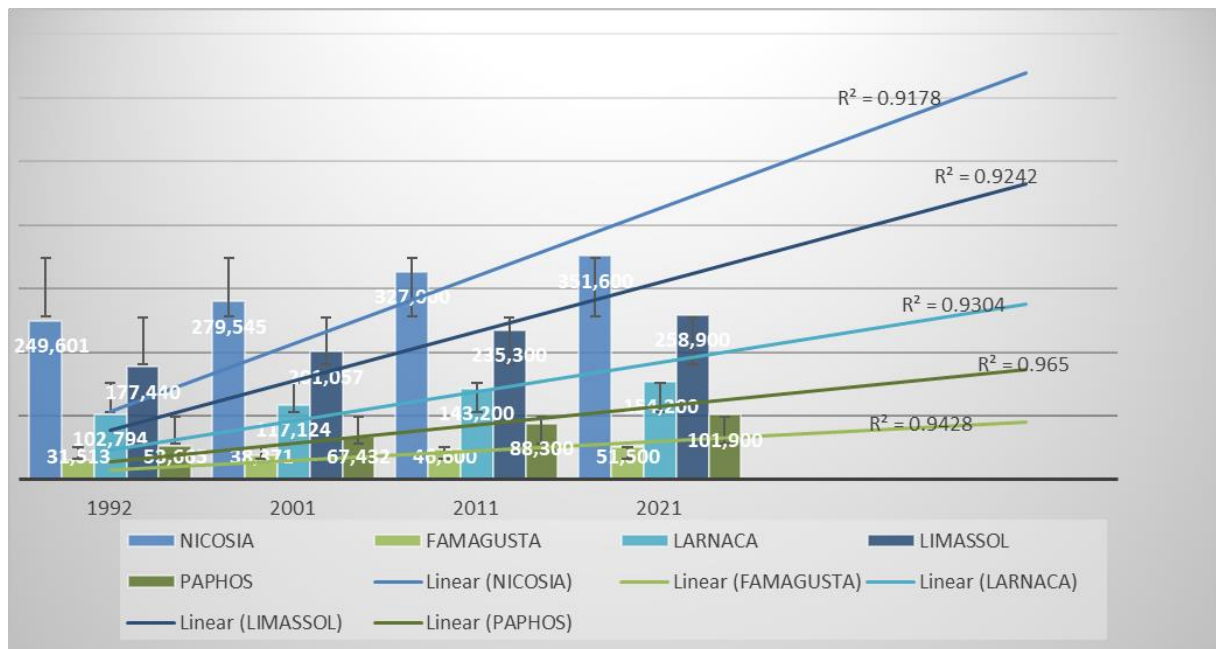
The city of Limassol saw a sharp increase in development and population starting in 1974. It is evident from the table how the population has grown in between censuses. The population change in the free areas between 1992 and 2001, according to population censuses, was about 14.4%. Up until the 2011 census, when Cyprus's population increased by some 19% in its urban areas and by 21.8% overall, the upward trend was even more noticeable. This is also evident from the most current preliminary census data from 2021, which show that the island's population increased by 9.2% but at a slower rate overall.

The island's population is predicted to continue growing overall, with Nicosia and Limassol experiencing a greater rate of population growth than the rest of the island. It noted that the four urban agglomerations concentrate about 80% of the country's total population. According to the Cyprus Statistical Service, the current population is 1,268,467, increasing by 0.66% from 2023 and continuing the pattern of growth from 2022 to 2023 with an increase of 0.69%.

Population growth is putting pressure on existing housing supply, creating significant challenges to meeting demand for housing, resulting in shortages, rising prices and increased competition between buyers and renters while intensifying the housing sector. In 2023, an increased demand for residential properties was recorded as according to the number of sales carried out, more than 70% of the total value of transactions concern residential properties

with apartment transactions constituting 60% of this percentage and exceeding the single - family residence. After residential real estate, land and plot transactions follow, representing 16% of the real estate market share, followed by mixed commercial/residential buildings and finally offices.

Chart 9: Population forecast



Source: Developed for this report

The largest Municipality, according to the data of the most recent census, is the Municipality of Limassol with a population of 108,105 people and 50,183 dwellings, which corresponds to 54.4% and 55.8% of the total urban area of Limassol, respectively. Limassol appears to have presented the second largest percentage increase in residences of 15.4%, after Famagusta.

In the urban areas of the province of Limassol, the Municipality of Germasogeia appears to present the largest percentage increase in the 2021 census compared to 2011 both in residences and in population with percentages of 35.6% and 29.1% respectively. At the same time, the Municipality of Ypsonas also recorded a fairly large increase with 31.5% in residences and 25.6% in the population. The Municipality of Ipsonas as well as part of the Municipality of Germasogeia (north of the highway) constitute suburban areas. The Municipality of Germasogeia traditionally attracts a population with high incomes as it

gathers the largest number of luxury houses and high-rise apartments. The Municipality of Ipsonas, on the contrary, is a newly built area which has developed rapidly in recent years due to the huge increase in housing prices within the urban center and urban gentrification.

It is noted that until recently the Municipality of Ipsonas was an area with affordable housing which mainly attracted families from the region who wanted to be close to the city. It retained the rural character of the "village" and was considered a degraded/lower class area for the urban population. However, the housing needs have made Ipsonas the most popular destination for the purchase of a home among the new families of the city. As it was expected and based on the rules of the free market, the increased demand increased the values of the properties with the subsequent search for housing even further west towards the communities of Kolossi, Erimi, Episkopi and even in Souni-Zanakia.

Analyzing the population data and the number of houses during the last 2 censuses, it is noticed a huge increase is recorded. A greater percentage increase is observed in the peri-urban areas where there was an available land reserve than in the urban areas and especially in the Municipality of Limassol which is the urban core. Municipalities that traditionally house high-end residences, such as the Municipality of Germasogeia and Mouttagiaka, show an imbalance with a much lower increase in housing than population, emphasizing the investment activity in the area and not the permanent settlement. However, this is also observed in areas that traditionally attract locals and families, which indicates the shrinking of households and the reduction of the number of people per household. The regions of Armenochori and Tserkezi recorded a decrease both in the number of households and in the number of dwellings. The Armenochori area is a relatively underdeveloped residential area which is not directly connected to the city of Limassol and is not a popular choice for a permanent residence. The Tserkezi area on the other hand is a former agricultural area which is now a tourist and residential resort due to the development of the City of Dreams Casino, which was operational in the summer of 2023, i.e. 2 years after the last census. By 2021, large areas of land had been acquired in order to benefit and develop residentially after the regeneration of the area.

It is noteworthy that the peri-urban areas which are within the new administrative boundaries of the Limassol Municipalities show the greatest percentage increase both in residences and

in population. These areas are connected to the urban center by main roads of prime importance while offering lower housing prices. A greater percentage increase was recorded in Souni-Zanakia with a percentage increase of the population approaching 50%. As has already been discussed above, the increasing property values push the local population to the westernmost areas of the suburban area. The eastern communities are traditionally a destination for luxury homes and are not preferred by the local population.

Table 3: Number of houses and population per quarter

AREA	HOUSES		POPULATION		CHANGE	
	2021	2011	2021	2011	Houses change (%)	Pop. Change (%)
Limassol District	132,305	114,662	262,238	235,330	15%	11%
Main Urban area						
Limassol Municipality	50,183	45,380	108,105	101,000	11%	7%
Mesa Geitonia Municipality	6,607	6,020	15,949	14,477	10%	10%
Ag. Athanasios Municipality	6,707	5,522	16,563	14,347	21%	15%
Sub-urban area within the new administrative areas						
Germasogeia Municipality	11,254	8,298	17,325	13,421	36%	29%
Pano Polemidia	1,337	1,272	3,419	3,470	5%	-1%
Ipsonas Municipality	4,968	3,777	13,966	11,117	32%	26%
Kato Polemidia Municipality	8,869	8,091	23,231	22,369	10%	4%
Mathikoloni	92	90	200	174	2%	15%
Mouttagiaka	1,700	1,290	3,243	2,939	32%	10%
Armenochori	74	81	211	218	-9%	-3%
Finikaria	227	182	460	339	25%	36%
Akrounta	285	209	521	455	36%	15%
Agios Tychon	4,050	3,211	4,413	3,455	26%	28%
Akrotiri	404	378	933	870	7%	7%
Asomatos	356	290	893	726	23%	23%
Tserkezi	19	21	52	50	-10%	4%
Trachoni	1,604	1,343	4,569	3,952	19%	16%
Kolossi	2,292	2,058	6,478	5,651	11%	15%
Erimi	1,238	986	3,156	2,432	26%	30%
Episkopi	1,594	1,418	4,111	3,681	12%	12%
Kantou	191	146	412	349	31%	18%
Sub-urban area outside the new administrative areas						
Parekklesia	1,821	1,377	3,489	2,738	32%	27%
Palodia	693	548	2,115	1,568	26%	35%
Fasoula	378	274	730	560	38%	30%
Souni-Zanakia	751	515	1,245	837	46%	49%

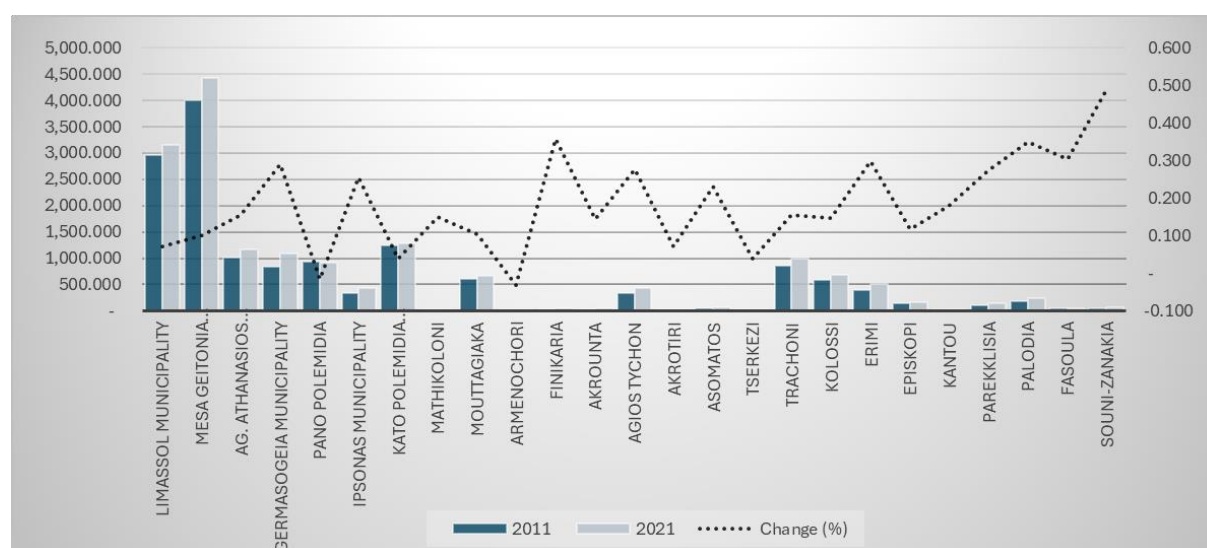
Source: Cyprus Statistical Service, Developed for this report

City size and density are crucial to economic growth. The possibility of finding affordable housing is an incentive for interregional mobility of the population, thereby attracting labor force and increasing productivity (Rodriguez & Storper, 2019). As argued by equilibrium

theory, city size and population growth are the only important factors in economic growth because once the conditions for population growth are created, jobs and output growth will follow.

The relationship between housing availability and land supply and the growth of the urban population is the driving force for economic growth. But what happens in a city that loses its local population and relies entirely on migrating population and investments? The increase in population and the increased demand recorded in Limassol has led to the utilization of a large part of the land stock that was scattered in the Local plan. The building factor within the Local Plan has an average of around 2%, in the largest part of the residential area it ranges from 1% - 1.2%.

*Chart 10: Density per quarter *Persons per square kilometer*



Source: Developed for this report

The population density recorded in the city is one of the lowest in Europe as in most cases of development the growth rate is not exhausted to the maximum due to the prevalence of single-family housing. An important role in this in Cyprus, is played also by the retention of land in the urban center by a few landowners who do not intend to exploit it, resulting in the inelasticity of demand. At the same time, the local mentality for building single-family houses means that the rate is not used up and the city is spread out with a low density. This, however, seems to have changed in the last 5 years or so due to high property prices and high demand which has led to massive apartment buildings. According to Eurostat, since

2016 the density has increased by approximately 7 Persons per square kilometer reaching 99.1 Persons per square kilometer by 2022. It is noted that the average in Europe is 109.1 Persons per square kilometer (Eurostat, 2024).

Figure 9: Sprawl in Germasogeia area



Based on the densities estimated for the urban center and the peri urban areas, the diagram indicates that, as would be predicted, higher densities are seen in the urban core, that is, in the Municipalities of Mesa Geitonia and Limassol. The Municipality of Mesa Geitonia exhibits a higher density, which is thought to be caused by the abundance of older or listed buildings in the Municipality of Limassol's historical center. Every community saw a rise in population density, with the exception of Pano Polemidia community. The peri-urban communities of Finikaria, Erimi, Palodia, and Fasoula saw a higher increase in population density—more than 30%—while the community of Souni - Zanakia saw a population density increase of almost 50%. The increased densities in peri-urban communities emphasize the pressures on the peri-urban space to house the new population as well as the

intense environmental pressures from the new development as well as the construction process disrupting the sustainable development.

4.6. Affordably in Limassol and sprawl

According to the statistics presented in the PWC report, Limassol dominates the supply and number of high value sales. Of the 10 most expensive sales recorded in 2023 throughout Cyprus, 9 took place in Limassol. The managing director of Ask Wire, Pavlos Loizou, emphasized at the same time that seven of the most expensive transactions involved land, including the most expensive sale in Cyprus, which took place in Limassol at a cost of 22.1 million euros (PWC, 2024). It is emphasized that the fifty largest transactions, carried out throughout Cyprus, amounted to a total of 285.8 million euros, among these transactions the ten most expensive sales amounted to a value of 120.4 million euros.

Despite the contraction in the value of transactions in Limassol by 8% from 2022 to 2023, the number of sales contracts filed with the land registry increased by 9% and Limassol continues to absorb the largest share of transactions, accounting for 41% of the total value of Cyprus. The district of Limassol continues to dominate the share of high-value residential sales, where in 2023 three-quarters of the entire Cypriot total of such transactions took place. In 2023, the largest part of the volume of transactions, 30% of the total number, took place in Limassol, maintaining the first position both in terms of value and volume.

Continuing the analysis, during 2023, there was a significant increase of 16% in sales contracts submitted to DLS, throughout Cyprus, for the acquisition of real estate by foreigners (reaching 6,900 contracts). Limassol represents 34% of transactions from foreigners. Despite the fact that, according to the Statistical Service, the number of building permits in Limassol recorded a decrease of 6% both in 2022 and in 2023, the area (m²) of the permits as well as the property values showed an increase. Furthermore, a significant increase was recorded in the number of units to be licensed in rural areas despite a decrease in the number of building permits issued highlighting the construction of single developments in rural areas.

As seen on the Residential Property Price Index, Limassol has the highest prices per square meter for both houses and apartments. Most of the houses are located in the peri-urban area,

while in the center of the city there are many apartments. This leads to a greater increase in prices for real estate within the urban core, i.e. apartments, due to increased demand from foreigners, and a smaller increase in the prices of detached houses. As we have already studied, the local culture is oriented towards large houses, this in combination with the economic pressures leads to a preferable purchase of a residence in an out-of-town area rather than choosing an apartment in the urban center. The need for a larger residence appears to offset the transportation burden.

However, the new conditions, rising costs, high interest rates, expanded inflation and strong demand, have led to a reduction in the area of the new houses, as can be seen from the characteristics of the building permits that were issued. This is seen as a positive result of rising house values as economic pressures lead to more sustainable solutions, such as choosing smaller homes, approaching the European average dwelling size.

4.7. Government Policies toward urban sprawl

Due to the dependence of the island's GDP on services, government policies are based on strengthening the tertiary sector and trying to maintain it at the highest desirable levels. Because the island is small, support from outside sources and positive externalities is thought to be crucial for the local economy. The policies of the government are directly related to the attraction of additional investments and investment funds, with the aim of transforming the island into a high-level investment destination. Cyprus provides an attractive tax system, integrated legal and regulatory framework in order to attract investors and expand the service sector by exploiting its natural comparative advantages that attract a large number of global migrants. In 2023, almost 200,000 companies were registered in Cyprus of which 12,674 were new companies added during 2023 (Ministry of Energy, Commerce and Industry, 2024).

Cyprus offers Tax Optimization, providing various tax benefits with a corporate income tax of 12.5%, the lowest in Europe. At the same time, residence permits for incoming foreign workers can be secured very easily and in a short period of time. It takes approximately 4-6 weeks to obtain a residence permit. To acquire a permanent residence in Cyprus, it takes approximately 3-6 months and requires an investment of at least 300,000 euros in real estate,

shares of Cypriot companies or shares of investment funds that are registered and operate in Cyprus. There is also no annual property tax, owners only pay a small annual amount in council tax. Planning authorities issue an unlimited number of building permits for high-rise towers with luxury properties, featured and luxury resorts with prospective buyers and foreign investors as seen in Tserkezi - Asomatos area with the “City of Dreams Casino” Development”, causing a huge increase in construction and property prices in their wider area.

However, it seems that the government ignores the impact on the local population who are suffering to keep up with the increased costs resulting from the introduction of new high-income population. The statements of Mr. Kourousidis, president of the association of real estate appraisers, are considered worrying, as he explains that the increased attraction of investors and foreign companies can only offer benefits, ignoring its social as well as urban planning and environmental impacts. Nonetheless, the governmental authorities promote peri-urban development by encouraging the relocation of the population to peri-urban or even rural areas with the "Housing Plan for the Revitalization of Mountainous, Critical and Disadvantaged Areas". Thus, in a transport system that is unable to serve urban movements, daily rural-urban movements are added, marking the dependence on private vehicles.

The Cyprus Recovery and Resilience Plan aims to strengthen infrastructure in the green and digital transition, as well as in healthcare, education and tourism, while housing policy measures are theoretically supported such as the government subsidized rental housing loan scheme and other direct subsidies for economically weaker groups. However, the financial assistance that is provided is limited and is mainly addressed to very low-paid individuals or vulnerable groups (DANOS, 2023). At the same time, the decrease in the surface area of the units recorded in the recently issued building permits seems to be related to the adoption of the reduced VAT rate to 5%, and not 19%, if the property is the first for the buyer and intends to live there. The reduced rate only applies to smaller homes, up to 130 m², with a maximum value of €350,000.

5. Discussion, Recommendations

Failure to house the population endangers local economic development and intensifies geographic inequalities. Urban gentrification, long commuting times, declining quality of life, homelessness and economic marginalization of population groups emerge from a failed housing market.

The ongoing policy to attract new investors and companies doesn't seem to be slowing down despite overcrowding and the huge increase in housing costs for locals. It is generally considered that the purpose of the authorities is economic growth without economic development. Despite the increasing nominal increase in GDP, no improvement was observed in the education system, the health and insurance system, the fight against corruption, the flexibility of the bureaucracy and the improvement of the quality of life of the local people who are mostly deprived of the basic need of acquiring a residence. Economic growth, in addition to an increase in per capita income, requires structural changes in the structure of the economy.

Based on the results of the research and the processing of the available data, it is now evident that the increased property prices are closely related to the urban sprawl. At the same time, the urban center is gentrifying as real estate prices are unapproachable based on the average salary of the population. While investors and high-income foreigners, choose to buy luxury properties in Cyprus due to the significant advantages of the island, real estate prices are becoming unaffordable for the locals. At the same time, the huge demand created in the city center by the foreign workforce in combination with increased costs, inflation and high interest rates alleviate the challenge even more and this has as a consequence the search for more affordable housing by the locals in areas with lower land values, i.e. in peri-urban, rural areas thus intensifying the urban sprawl.

For the successful development of the city of Limassol by integrating the new high-income population without affecting the living conditions of the existing population, it is necessary to understand the importance and the benefits resulting from the creation of a compact city with mixed-use neighborhoods, where different social categories of population can coexist.

The Limassol Local Plan was designed in 2011 with a revision in 2013. A plan over 10 years old that does not respond to the contemporary society of investments, increased population and worsening social inequalities. Therefore, the first step to achieving sustainable development, environmental protection and mitigating social inequalities is the establishment of a single strategic plan that will respond to the needs and structure of the contemporary city to limit sprawl and promote the compact city. The objective of such a plan is to enhance the efficacy of land uses and existing infrastructure, incorporating human-centered planning that takes into account the existing urban form and contributes to homogeneous mixed-use development, with human-centered neighborhoods and communities and a distinct hierarchy of open spaces that significantly enhances infrastructure, such as green zones (Bueno-Suárez & Coq-Huelva, 2020). It is also, necessary to combine housing options to serve different sections of the population by including quality housing, of different types and prices, to incorporate in the design the different transportation options such as mass transit, cycling and walking by creating safe and attractive walking routes in a balanced transportation system where all forms of transportation are reliable, efficient and user-friendly.

Reducing the ecological footprint of cities, in line with Sustainable Development Goal (SDG) 11 ("Make cities inclusive, safe, resilient and sustainable") leads to improved quality of life in cities that recognize the value of public open space, of culture and heritage, in sustainable cities (Behnisch, et al., 2022). Creating a need to use public transport and promoting the need to live in or near the urban center to be served by them. Research shows that reducing the number of private car ownership is one of the main methods to control the spread. Therefore, the use of private vehicles should become a deterrent and should not be the only and necessary means of transport. A sprawl development makes the operation of a sustainable transport system impossible and opposes the principles of sustainable development and of all 17 SDGs.

At the same time studies have shown that urban sprawl costs 20 times more than developing areas within an urban core due to the needs for news, schools, housing and public services. Therefore, increasing or imposing taxation on growth in areas not covered by existing infrastructure can play an important role in controlling sprawl.

Even so, the control of the development in the peri-urban area and the protection of the land with a clear definition of the urban borders and the development areas are considered essential. Enact a high value tax designation for change of use and development in non-residential area to discourage development on agricultural land far from necessary infrastructure and similarly tax for undeveloped land within the urban core with the aim of indirectly forcing their development and full utilization of urban land.

The goal of the state departments should, in a primary stage, be the improvement of the quality of life of the local population, both at a social and economic level, and in a secondary stage, the attraction of investments and new population. A significant portion of residents who choose to relocate to the suburbs are people who migrate to improve their family life. The transition of cities from a built environment to a sustainable one with open public spaces combined with financial credits and regional subsidies are some solutions to improve their living conditions within urban boundaries.

Support smart development strategies based on compact development and regeneration of residential area in a city and integrate urban sprawl measures to evaluate and compare different settlement patterns are vital actions to strengthen the transformative capacities of the city of Limassol. Although inner-city redevelopment tends to increase the price of urban land, the development of vacant lots within urban boundaries and the rehabilitation and reuse of derelict buildings will create new housing stock and increase supply by offsetting increased demand.

Future, development and sustainability efforts should focus on SDG 11, which Limassol has committed to achieving by 2030 (Ranjan, et al., 2022). To achieve sustainable growth in a sustainable city, increase urban density and limit wasted urban land in a crucial and mandatory factor, in order to achieve compact city characteristics, reducing infrastructure costs and increasing the need to use public transport.

6. Conclusions

In the subsection "Urbanism and social commons" Giddens (2009) mentions that the spatial form of a society is closely related to the more general mechanisms of its development. It is emphasized that the urban environment expresses symbolic and spatial identities of the social groups that use it. Financial institutions and large corporations exert significant pressure on the processes of "consumption" of services, housing and infrastructure while the public sector influences market mechanisms by building infrastructure and providing social services.

The contemporary problem of urban sprawl is faced by many developing countries around the world, which are faced with population growth as a result of globalization and the free movement of labor (Mangweta, et al., 2022). The phenomenon of uncontrolled suburbanization, if governments do not take the necessary preventive measures, can ultimately lead to disastrous results for both the natural and the built environment. As in an unfree real estate market, the mechanisms of the real estate market alone cannot control the direction of development, it is necessary to map and monitor the changes in the urban core and guide the urban planning.

In this study for the city of Limassol, the residential area is considered as an indicator for estimating urban sprawl. Using aerial images from Landsat satellites, for the years 2011, 2021 and 2024 it is highlighted that there is an alarming increase in residential area from 2011 to 2024. To evaluate and monitor the changes in the urban structure, continuous spatial and temporal monitoring of the phenomenon and its identification through the processing of satellite images over time using integrated GIS and remote sensing technologies is necessary. Specific applications of remote sensing allow planners to better predict future levels of sprawl for a range of design scenarios, set environmental standards, and assess the effectiveness of mitigation measures.

The use of such systems can help to reduce unnecessary urban expansion and thus help maintain the viability of urban environments and the sustainable and long-term development of the city avoiding a possible decline. Urban planning authorities can make use of such urban sprawl analysis methods for more effective city planning and sprawl control. In

parallel with the recognition and assessment of the problem, they should sound the alarm to other government agencies to limit the number of newly arriving population to protect the locals and the sustainability of the cities.

The city started its sprawling trend due to the huge increase in population, especially high-income population that activated the construction sector especially after the financial crisis of 2013. The huge increase in demand led to a dramatic increase in real estate prices, in which the local population cannot cope, resulting in the search for more affordable housing alternatives (Oueslati, et al., 2015). Today, Limassol is expanding rapidly. City dwellers prefer larger houses and a better living environment in the suburbs where houses are at the same time cheaper than apartments in the urban core. The government has become the main driver of urban expansion in pursuit of new development space as it adopts policies that lead to increased demand and promote relocation to peri-urban areas. With prosperous urban areas and rapid GDP growth, a number of serious social problems have gradually emerged. Peri-urban areas are faced with the loss of cultivated land, while the separation between different social classes, ecological degradation and unbalanced development between urban and rural areas are strongly observed.

With this study and our analysis, we have answered all of our research questions despite the limited data at the local level. To a large extent the identification of the problem and the depiction of the specific areas experiencing urban sprawl was based on our empirical identification. The urban sprawl in Limassol is affected to a large extent by the increase in real estate prices, while unregulated construction has led to significant environmental issues (Spirkova, et al., 2020) that hinder sustainability goals. Rapid and unexpected growth and fragmentation of urban land uses, pose significant social threats and hinder sustainable development and mitigation measures must be taken in order to prevent the problem and achieve sustainability in the city of Limassol. On the other hand, studies argue that a sprawling city promotes lifestyles that reconnect humans with nature while being close to the city and enjoying the benefits of urban life (Yasin, et al., 2021). However, based on the study's evidence, and as many scientific articles that we have examined, we tend to believe that urban sprawl is a major societal and economic problem that is inextricably linked to sustainability, the environment and health.

References

1. Nubi, T. G., Anderson, I., Lawanson, T. & Oyalowo, B., 2021. *Housing and SDGs in Urban Africa*. Singapore: Springer.
2. Oueslati, W., Alvanides, S. & Garrod, G., 2015. Determinants of urban sprawl in European cities. *Urban Studies Journal*, p. Vol. 52(9) 1594–1614.
3. Spirkova, D., Adamuscin, A., Golej, J. & Panik, M., 2020. Negative Effects of Urban Sprawl. In: *Advances in Human Factors in Architecture, Sustainable Urban Planning and Infrastructure*. Warsaw: Springer, pp. 222-228.
4. Yasin, M. Y. et al., 2021. Urban sprawl literature review: Definition and driving force. *Geografia*, 2(17), p. 2021.
5. Abedini, A., Khalili, A. & Asadi, N., 2020. Urban Sprawl Evaluation Using Landscape Metrics and Black-and-White Hypothesis (Case Study: Urmia City). *Journal of the Indian Society of Remote Sensing*, Volume 48, p. 1021–1034.
6. Asadi, N. & Habibi, S., 2011. Causes, results and methods of controlling urban sprawl. *Procedia Engineering*, pp. 133-141.
7. Ashraf, H. et al., 2022. Assessment of Urban Sprawl in Sargodha City using Remotely Sensed Data. *Ecological Questions*, 4(33), p. 131–140.
8. Barrington-Leigh, C. & Millard-Ballb, A., 2015. A century of sprawl in the United States. *Proceedings of the National Academy of Sciences*, 112(27), p. 8244–8249.
9. Behnisch, M., Krüger, T. & Jaeger, A. G. J., 2022. Rapid rise in urban sprawl: Global hotspots and trends since 1990. *PLOS Sustain Transform*, 1(11), p. e0000034.
10. Bhumika, D., Farhan, . K. & Pir, M., 2023. Impact of urban sprawl on change of environment and consequences. *Environmental Science and Pollution Research*, p. 30:106894–106897.
11. Bourennane, S. & Kubicek, P., 2022. *Geoinformatics and Data and Data: Selected Proceedings of ICGDA*. Cham, Springer .
12. Bueno-Suárez, C. & Coq-Huelva, D., 2020. Sustaining What Is Unsustainable: A Review of Urban Sprawl and Urban Socio-Environmental Policies in North America and Western Europe. *Sustainability*, Issue 12, p. 4445.
13. Buglo, I., 2024. *Living in Cyprus: pros and cons of spending your life in the heart of the Mediterranean*. [Online]
Available at: <https://imin-cyprus.com/guide/living-in-cyprus-for-expats/>
[Accessed 2 June 2024].
14. Buglo, I., Cost of living in Cyprus: a detailed guide for expats. *Igor Buglo*. [Online]
Available at: <https://imin-cyprus.com/guide/cyprus-cost-of-living/>
[Accessed 25 June 2024].

15. Central Bank of Cyprus, 2024. *Residential Property Price Indices*. [Online]
Available at: <https://www.centralbank.cy/en/publications/residential-property-price-indices>
[Accessed 30 June 2024].
16. Coheci, R.-M. & Petrisor, A.-I., 2023. Assessing the Negative Effects of Suburbanization: The Urban Assessing the Negative Effects of Suburbanization: The Urban. *Land*, pp. 12, 966.
17. DANOS, 2023. *Cyprus Market Report*, Nicosia: Danos International Property Consultants & Valuers.
18. Díaz-Pacheco, J. & García-Palomares, J. C., 2014. Urban Sprawl in the Mediterranean Urban Regions in Europe and the Crisis Effect on the Urban Land Development: Madrid as Study Case. *Urban Studies Research*.
19. Ehrlich, M. V., Hilber, C. & Schöni, O., 2017. Institutional settings and urban sprawl: Evidence from Europe. *Journal of Housing Economics*, p. 42(601).
20. European Environment Agency, 2016. *Urban sprawl in Europe: Joint EEA-FOEN report*, Luxembourg: Publications Office of the European Union,.
21. Eurostat, 2024. *Data Browser*. [Online]
Available at: <https://ec.europa.eu/eurostat/databrowser/>
[Accessed 25 June 2024].
22. Gargiulo, V., Sateriano, . A., Di Bartolomei, R. & Salvati, L., 2012. Urban Sprawl and the Environment. *Geography, Environment, Sustainability*, pp. 5(4):46-6.
23. Garriga, C., Hedlund, A., Tang, Y. & Wang, P., 2021. Rural-urban migration and house prices in China. *Regional Science and Urban Economics* , Volume 91, p. 103613.
24. Giddens, A., 2009. Urbanism and social commons. In: T. D. (Translated), ed. *Sociology*. Athens: Gutenberg, pp. 613-652.
25. Hamidi, S. et al., 2018. Associations between Urban Sprawl and Life Expectancy in the United States. *Environmental Research and Public Health*, pp. 15, 861.
26. Hamidi, S. et al., 2018. Associations between Urban Sprawl and Life Expectancy in the United States. *International journal of environmental research and public health*, 5(15), p. 861.
27. Han, H., Kim, S., Jin, M. Y. & Pettit, C., 2021. Providing affordable housing through urban renewal projects in Australia: Expert opinions on barriers and opportunities. *International Review for Spatial Planning and Sustainable Development* , 2(9), pp. 41-61.
28. Hosseini, S. H. & Hajilou, M., 2015. Drivers of urban sprawl in urban areas of Iran. *Papers in Regional Science*, 2(98), pp. 1137-1158.

29. Ibimilua , . F. A. F., Ibimilua, O. . F. & Ogundare , . A. B., 2020. Urban Sprawl: Environmental Consequence of Rapid Urban Expansion. *Malaysian Journal of Social Sciences and Humanities (MJSSH)*, pp. Volume 5, Issue 6, (110 - 118).
30. Izakovičová, Z., Petrovič , F. & Pauditšová , E., 2022. The Impacts of Urbanisation on Landscape and Environment: The Case of Slovakia. *Sustainability*, 1(14), p. 60.
31. Jaeger, J. A. G., Krüger, T. & Behnisch, M., 2022. Rapid rise in urban sprawl: Global hotspots and trends since 1990. *PLOS SUSTAINABILITY AND TRANSFORMATION*.
32. Johnson, M. P., 2001. Environmental impacts of urban sprawl: a survey of the literature and proposed research agenda. *Environment and Planning A*, pp. volume 33, pages 717 ^ 735.
33. Karma , T. & Komal , R. A., 2022. Semi-automatic classification for rapid delineation of the geohazard-prone areas using Sentinel-2 satellite imagery. *SN Applied Sciences*, 4(141).
34. Krishnaveni, K. & Anilkumar, P., 2020. Managing Urban Sprawl Using Remote Sensing and GIS. *Remote Sensing and Spatial Information Sciences*, XLII-3-W11(59), p. 59–66.
35. Lepetit, Q., Viguié, V. & Liotta, C., 2023. A gridded dataset on densities, real estate prices, transport, and land use inside 192 worldwide urban areas. *Data in Brief*, Issue 47, p. 108962.
36. Li, H. & Wei, Y. D., 2020. Spatial Inequality of Housing Value Changes since the Financial Crisis. *Applied Geography, Volume 115*, pp. 02141, ISSN 0143-6228..
37. Litynski, P., 2021. The Intensity of Urban Sprawl in Poland. *ISPRS International Journal of Geo-Information*, Volume 10, p. 95.
38. Lityński, P. & Hołuj, A., 2017. Urban sprawl costs: The valuation of households' losses in Poland. *Artur Hołuj*, 1(8), pp. 11-35.
39. López, G. A., 2023. Recent Transformations in the Morphology of Spanish Medium-Sized Cities: From the Compact City to the Urban Area. *Land*, 12(7)(1276).
40. Lopez, R., 2004. Urban Sprawl and Risk for Being Overweight or Obese. *American Journal of Public Health*, pp. Vol 94, No. 9.
41. Łukomska,, J. & Neneman, J., 2020. Urban sprawl and the financial standing of municipalities. *Optimum. Economic Studies* 4, 102(4), pp. 40-57.
42. Macrotrends, 2024. *Cyprus Net Migration Rate 1950-2024*. [Online]
Available at: <https://www.macrotrends.net/global-metrics/countries/CYP/cyprus/net-migration>
[Accessed 2 June 2024].
43. Magliocca, N., McConnell, V. & Walls, M., 2015. Exploring sprawl: Results from an economic agent-based model of land and housing markets. *Ecological Economics*, p. 114–125.

44. Mangweta, R., Mokoele, N. . J. & Monama, S. A., 2022. Building sustainable cities to address urban sprawl: a reflective analysis towards achieving SDGs. *EUREKA: Social and Humanities*, Volume 6, p. 7278.
45. Ministry of Energy, Commerce and Industry, 2024. *Department of Registrar of Companies and Intellectual Property*. [Online]
Available at: <https://www.companies.gov.cy/en/>
[Accessed 5 July 2024].
46. Ministry of Finance, 2024. *Cyprus Recovery and Resilience Plan (RRP)*. [Online]
Available at: <https://cyprus-tomorrow.gov.cy/cypresidency/kyprostoavrio.nsf/home/home?OpenDocument>
[Accessed 01 June 2024].
47. Ministry of Interior, 2016. *National Report. HABITAT III: Third United Nations Conference on Housing and Sustainable Urban Development*, Nicosia: Republic of Cyprus.
48. Morollón, F. R., 2016. Urban sprawl in Spain: differences among cities and causes. *European Planning Studies* , 24(1), pp. 207-226.
49. PWC, 2024. *Cyprus Real Estate Market*, Nicosia: PricewaterhouseCoopers Ltd..
50. Ranjan, R., Firoz, M. C. & Rajendran , L. P., 2022. Sustainable Development Goals: An Overview of the Interconnected Relationship of SDGs and Urban and Regional Development. In: R. Brears, ed. *The Palgrave Encyclopedia of Urban and Regional Futures*. London: Palgrave Macmillan, p. 1–13.
51. Republic of Cyprus, 2024. *Statistical Service*. [Online]
Available at: <https://www.cystat.gov.cy/en/default>
[Accessed 01 June 2024].
52. Rodriguez, A. & Storper, M., 2019. *Housing, urban growth and inequalities: The limits to deregulation and upzoning in reducing economic and spatial inequality*, London: Department of Geography and Environment, London School of Economics.
53. Rosni, A. & Noor, N. M., 2016. A Review Of Literature On Urban Sprawl: Assessment Of Factor And Causes. *Journal of Architecture, Planning and Construction Management*, 6(1).
54. Rubiera-Morollón, F. & Garrido-Yserte, R., 2020. Recent Literature about Urban Sprawl: A Renewed Relevance of the Phenomenon from the Perspective of Environmental Sustainability. *Sustainability*, Issue 12, p. 6551.
55. Sarkodie, S. A., Owusu, P. A. & Leirvik, T., n.d. Global effect of urban sprawl, industrialization, trade and economic development on carbon dioxide emissions. *Environmental Research Letters*, 3(15), p. 034049.
56. Seyyed , H. H. & Mehran, H., 2018. Drivers of urban sprawl in urban areas of Iran. *Papers of the Regional Science Association*, 2(98), pp. 1137-1158.

57. Shawly, H., 2022. Evaluating Compact City Model Implementation as a Sustainable Urban Development Tool to Control Urban Sprawl in the City of Jeddah. *Sustainability*, 20(14), p. 13218.
58. Silva, C. & Perucich, F. V., 2021. Determinants of urban sprawl in Latin America: evidence from Santiago de Chile. *SN Social Sciences*, 1(8), p. 202.
59. Sinha, S. K., 2018. Causes of Urban Sprawl: A comparative study of Developed and Developing World Cities. *RESEARCH REVIEW International Journal of Multidisciplinary*, III(9), pp. 05-09.
60. Surya, B. et al., 2021. Land Use Change, Urban Agglomeration, and Urban Sprawl: A Sustainable Development Perspective of Makassar City, Indonesia. *Land*, Issue 10, p. 556.
61. Trading Economics, 2024. [Online]
Available at: <https://tradingeconomics.com/>
[Accessed 01 June 2024].
62. United Nations Statistics Division, 2024. *Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable*. [Online]
Available at: <https://unstats.un.org/sdgs/report/2017/goal-11/>
[Accessed 01 June 2024].
63. Van Doorn, L., Arnold, A. & Rapoport, E., 2019. In the Age of Cities: The Impact of Urbanisation on House Prices f Urbanisation on House Prices. In: H. P. L. M. H. W. Nijskens R., ed. *Hot Property: The Housing Market in Major Cities*. Amsterdam: Springer , pp. 3-14.
64. Wang, J., Mok, D. & Sun, X., 2021. Real options, housing price risk, and urban sprawl: A case study of the Toronto census metropolitan area using remotely sensed data, 1986–2016. *Regional Science*, pp. 1273-1294.
65. Wilhelmsson, M., Ismail, M. & Warsame, A., 2022. Gentrification effects on housing prices in neighbouring areas. *International Journal of Housing*, 15(4), pp. 1753-8270.
66. Wu, T. & al, 2021. Urban sprawl and childhood obesity. *Obesity Reviews*, p. 22(S1):e13091..
67. Xiaoxiao, W., Ruiting, S. & Ying , Z., 2020. Dynamics of urban sprawl and sustainable development in China. *Socio-Economic Planning Sciences*, Volume 70, p. 100736.
68. Yan, Y., Hui, L. & Canfei, H., 2021. How Does Urban Sprawl Affect Public Health? Evidence from Panel Survey Data in Urbanizing China. *Environmental Research and Public Health*, pp. 18, 10181.
69. Yasin, M. y., 2020. Is urban sprawl a threat to sustainable development? A review of characteristics. *Research Gate*.
70. Young, M., Tanguay, G. A. & Lachapelle, U., 2016. Transportation costs and urban sprawl in Canadian metropolitan areas. *Research in Transportation Economics*, pp. 1-10.

