

Integrating Smart Growth Icons with Sustainable and Real Estate Strategies

Master Thesis

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From:

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"The greatest achievement was at first and for a time a dream. The Oak sleeps in the acorn, the bird sleeps in the egg, and in the highest vision of the soul, a waking angel stirs. Dreams are the seedlings of realities..."

- *James Allen*



**International Master of Science in Construction and Real Estate Management
Joint Study Programme of Metropolia Helsinki and HTW Berlin**

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Conceptual Formulation

Master Thesis for Ms _____ **Karen Jurado** _____

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Topic:


Integrating Smart Growth Icons with Sustainable and Real Estate Strategies

Abstract

Smart growth has been a topic of revolution, a way of creating sustainable and reliable cities by helping the residential and commercial fields with stakeholders from real estate and urban developers. However, is crucial to understand the feasibility of smart growth applied to each specific region from a city. The response of conducting smart growth is to provide communities with affordable housing and business opportunities without aiming for urban sprawl.

"The complete set of sustainability objectives aims at creating a diverse and open, flexible and cooperative, modern and green, as well as vibrant and restful environment which fosters community, co-creation, encounters and experiments, and is flexible to future changes in use. This will create long-term value for the municipality, the landowner, the developer, and the citizens". (Inc, 2018)

The relevance of this thesis is to respond to the private and public sectors for the demands of growing cities, by suggesting mixed-use developments, referred to as smart growth icons, in the cities of Mexico and Berlin. From the private and public point of view, this thesis will respond by integrating the relationship between sustainability and real estate, and suggesting the guidelines to follow to evaluate whether or not a mixed-use development in a specific location is feasible, benefits the real estate, maintains a sustainable approach, and complies with the urban planning methods regarding the city. In case the criteria mentioned above are not





met, this thesis will help by encountering and developing solid strategies to respond to such a demand in growing cities leading to smart growth and economic success for investors, real estate, and governments of the cities analyzed.

Urban redevelopment needs to be considered nowadays to aim for the demands of the growing population. This is a topic with high relevance since the population will keep increasing and the urge for more constructed space will always be at the top of city planning. Conducting an analysis of how urban changes influences the sustainability of cities and real estate its important planning future ways for society. (Ogle, 2017).

Keywords: Smart growth, Mixed-use developments, sustainability, real estate, liveable communities

Literature Review

The literature review was carefully evaluated from Science direct journals, as well as from the Metropolia University library database. Books and scientific papers were chosen to understand more about the relation of real estate in the market for mixed-use developments from the private and public industries. Information about the relevance for sustainable goals in liveable neighborhoods was extracted from different case studies after researching the most sustainable cities in the world and their main goals to achieve optimal urban planning to respond to overpopulated cities. Case studies were extracted from Mexico City, Masdar City, Abu Dhabi, and Bilbao.

Methodology

The methodology for this thesis relays on data collection from case studies of well-known sustainable countries such as Canada, Australia, Austria, Emirates, and Hong Kong, to be compared with current situations in the market from Germany and Mexico. Empirical data collection from both countries will serve for a database to address the relevant needs and benefits as well as their relationship in real estate revenues for developing sustainable mixed-use neighborhoods. Finally, after an extensive study, a selection of guidelines will allow determining if a mixed-use development is applicable in a region, in the cities of Berlin and Mexico City.

Discussion

There is a wide demand for housing in Germany as well as in Mexico. The main purpose of this thesis is to analyze if sustainable mixed-use developments are the solution for growing cities complying with the goals for sustainable residential and



commercial areas. The main idea for mixed-use developments is to create liveable communities and avoid urban sprawl in the city planning sectors.

Urban growing cities do not offer too much space for new construction; however, the sustainable mixed-use complexes can also evolve from the renovation of existent spaces within the community (Tam, Karimipour, Wang, & Le, 2018). With the high demand in housing and on growing businesses, mixed-use developments respond to the private investors and the real estate industry, it is of priority to find methods to integrate sustainability with a high revenue for the market.

Research Questions

Among the many ongoing questions with this thesis aiming for deep research and evaluation are:

1. Are smart growth icons, mixed-use developments, the real solution for ongoing growing cities such as Berlin and Mexico City?
2. How to integrate affording sustainability with real estate revenue?
3. Who wins more by creating sustainable mixed-use developments, the private or the public industry?
4. How risky are sustainable projects for the real estate industry?
5. Which guidelines are to consider to determine a mixed-use development, is it feasible?
6. Which are the guidelines for closing the gap between sustainable mixed-use construction and real estate?

Conclusion

The importance of this topic was selected to understand the evaluation criteria for mixed-use construction and the relation in the living demands for the population in high dense areas. This thesis will study the design and development of combined spaces and its benefits in the real estate industry for Berlin and Mexico City. A liveable community is widely recognized as a fundamental building element of a city, and a good starting point to create a truly sustainable community. It is important to define in which cases a mixed-use development will lead to a smart growth when balancing sustainability and the real estate industry.

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 30.08.2019

Signature of the Supervisor 1



Signature of the Supervisor 2

Abstract

Smart growth has always been a topic of revolution, it is a topic of high importance because population will continue to grow and more living space will be needed, therefore there is the need of finding a way of creating resilient and sustainable cities by encouraging synergy within urban planning, by planning urban mixed-use developments. Growing cities do not offer too much space for new construction in already dense districts and are often facing urban sprawl, however the sustainable-mixed use developments take place by constructing a total new site or by revitalizing an existent neighborhood. Therefore are smart grow icons the real solution for growing cities such as Berlin and Mexico City?

This research is merely to analyze the benefits of planning sustainable mixed-use developments, and understand their impact in the real estate market, the risk that the real estate industry takes, and which are the guidelines or principles to determine their feasibility in the market, how is it possible to close the gap between sustainable mixed-use and real estate revenue?.

The results are strongly based in the critical analysis of literature review and the study of international case studies displayed in the different smart growth necessities aiming to determine the feasibility of adopting mixed-use developments and how to incorporate sustainable approaches while encouraging the investors and real estate developers to meet the financial expectations. Therefore this research is aimed to inform the investors and developers with strategies of integrating sustainability with real estate with the focus on mixed-use planning developments.

Keywords: Smart growth, Mixed-use developments, sustainability, real estate, liveable communities

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List of Abbreviations

Fig.	Figure
MUD	Mixed-use Development
GCG	Green Climate Cities
GHG	Greenhouse gas
UN	United Nations
SDG	Sustainable Development Goals
GUD	Global Urban Development
EDGE	Excellence in Design for Greater Efficiencies
BREEAM	World's leading sustainability assessment method
SWOT	Strengths, Weaknesses, Opportunities, and Threats
SEDA	Sustainable Economic Development Assessment
ICLEI	Local Governments for Sustainability
LEDS	Low Emission Development Strategies
UNDP	United Nations Development Programme

1. Introduction

The world continues to face environmental and demographic challenges that emphasize the need for a strategic planning of resources and city growth (ICLEI: Local Governments for Sustainability, 2019). According to the World Population Data, the expected global population increase by the year of 2050 is for 28%, which means that the projected global population in 2050 will reach 9.9 billion people (Bureau, 2019). The United Nations Development Programme has found that cities continue to grow in population, and by the year of 2030 rural population will migrate to urban land, adding to these cities more population growth. Overall, by 2030 an expected 60% of the world population will reside in metropolitan territory (UN-Habitat, 2016).

This clearly states the need for providing a response to climate change and population increase while providing for more living space, or better said, this requires the cities to be ready to respond to population increase by adopting smart growth principles for greener environments. One of the main icons in smart growth is the urban planning of Mixed-use developments (Hyun Lee et al., 2013).

However it is crucial to understand the principles of incorporating Mixed-use developments in city planning, and the value that will create for the community, the developer, the investors, and the city, and moreover by understanding how to close the gap in integrating sustainable mixed-use developments in real estate portfolios. This is possible by studying the trends in the economy for such developments and the strategic plans of city development within the next decades.

The following research questions and objectives will be analyzed to create the conclusions in the shape of strategies that respond to investors and developers to integrate sustainability in real estate for mixed-use developments.

1.1 Research Questions

The determined questions for this research aiming for evaluation and analysis are:

1. Are smart growth icons, mixed-use developments, and the real solution for on-going growing cities such as Berlin and Mexico City?
2. How to integrate affording sustainability with real estate revenue?
3. Who wins more by creating sustainable mixed-use developments, the private or the public industry?
4. How risky are sustainable projects for the real estate industry?
5. Which guidelines are to consider to determine a mixed-use development, is it feasible?
6. Which are the guidelines for closing the gap between sustainable mixed-use construction and real estate?

These questions were stated in the conceptual formulation step, therefore some of them required of an amplification to properly connect with the research topic. The final responses are found in the conclusion chapter.

1.2 Research Objectives

1. To understand the relevance smart growth with the urban model of mixed-use developments to respond to the demands of growing population and effects urban sprawl.
2. To comprehend principles of mixed-use developments from the planning perspective, and conduct a SWOT analysis to determine its relevance.
3. To study the sustainable approaches for mixed-use developments.
4. To identify the roles of the private and public investors in real estate for mixed-use developments and the economic impact in a City.
5. To establish the best guidelines that determine the feasibility of a mixed-use development in a City.
6. To define the trending strategies to integrate sustainability methods in the real estate industry for new or existent mixed-use developments. (Integrate a relation with sustainable mixed-use developments and real estate revenue).
7. To examine the urban and market data analysis of Berlin and Mexico City to address the potential future of sustainable mixed-use developments.
8. To respond to the research questions and discuss the relevance of this study.

1.3 Research Methodology

This methodology for this thesis is strongly based in a critical analysis of a literature review from scientific sources, from global organizations and associations in the urban planning and sustainability sectors, and from case studies of cities around the world. The literature review was selected from its relevance to the topic, with updated publications from evaluated theories from the past, and trends of relevance in the present and for the future. The case studies allowed to have practical evidence and replicable practice for the purpose of this thesis. After conducting a critical review from the information, a set of principles and guidelines were determined to evaluate within the cities of Berlin and Mexico City with the objective of understanding the relevant needs and benefits in relation with real estate for adopting sustainable mixed-use developments, to provide answers to the research questions, strategies of integrating smart growth icons (mixed-use developments) with sustainability and real estate, and to discover future research topics related to this thesis.

1.4 Research Timescale

The Master Thesis was divided into the following tasks per month.

Date	Task
09-10.2020	Literature selection, review, and analysis
10.2020	Selection of statistics and case studies
11-12.2020	Deep analysis in sustainability and real estate for mixed-use developments, critical evaluation of data, and development of strategies in response to the research questions.
01.2020	Editing and submission

2. Smart Growth

While the globe faces many challenges of a continuous population growth and climate change, the cities face the challenge for having a strategic planning to cope with that population increase and environmental degradation. According to the global principles of building better cities, (Calthorpe, 2017), a resolution to unravel climate change is reliant on how the cities are planned, if a city is strategically planned, not only it will provide for environmental impacts, but it will also reflect enhancement in social well-being and economic endurance. These global principles also indicate that the main challenges nowadays with city planning is Sprawl.

Urban sprawl mainly relies on vehicle transport for the population migrating to the outer skirts of a city where density is less, and urbanization has not been strategically designed (UN-Habitat, 2015). In other words, sprawl is the opposite of having a structured plan for a city's urban development. Among the many consequences of a city with urban sprawl are that it isolates blocks, it creates lack of integration between and among districts, it does not connect the society, and it provokes segregation in the economic, environmental, and social principles of the population. A city is then well integrated and vibrant when it has interaction in its urban planning, allowing society to grow (Calthorpe, 2017).

How can a city embrace smart growth through the next decades? When a City grows smartly, it has a blooming effect in the environment, society, and economy. Smart growth is then a theory that generates resilient cities with a city planning that produces the opposite of urban sprawl. Smart growth encourages the cities by adapting to climate change with coping strategies and to rely on public transport by creating transit oriented developments, it also creates pedestrian and bike friendly neighborhoods, and it integrates the city's districts in a more compacted version instead of expanding and provoking urban sprawl, hence smart growth creates a sense of community by creating mixed-use environments with quality of life (Sackey, 2009).

Allowing a city to have a smart growth not only creates a solution for population increase, it also creates a contribution to climate change; the greenhouse gas emissions lower since the population does not have to depend mostly in their vehicles (UN-Habitat, 2016). Population also acquire a reduction in vehicle miles traveled, which creates a difference in the savings amount on auto fuel per household. By having pedestrian and bike friendly cities, there is also an impact in air quality, there is less air pollution, in other words, transit oriented cities aim for health improvement (Calthorpe, 2017). Transit oriented communities call for mixed-use developments, therefore smart growth greatly relies on sustainable multifunctional compacted neighborhoods, in other terms, smart growth relies on designing for mixed-use developments (UN-Habitat, 2015).

2.1 Mixed-use developments

In urban planning, mixed-use developments are globally categorized as smart growth icons resulting from a strategic compact integration of land uses within a block, a building, or a city space (Sackey, 2009) . The relevance and importance of planning cities to prepare for the growing population and climate change challenges, within the next decades, are aiming to adapt mixed-use developments to create lively and revitalized city districts (UN-Habitat, 2019). MUD happen to be the answer for a city's sustainable revitalization, bringing a set of concepts contrary to the existent urban sprawl, or unplanned development. It provides solutions for the environment and opportunities for the society.

A mixed-use development is a combination of at least three uses connecting to each other physically and functionally, the uses go from the residential, commercial, recreational, educational, and, or industrial uses, offering walkability to connect one use to another with the purpose of creating a work-live-play concept, and it can occupy a single building or an entire neighborhood (UN-Habitat, 2019). Appendix A displays the creation of synergies originated from a MUD. The main idea behind is to create mixed spaces where the users can easily walk and apply the concept of live-work-play within the same walking distance.

Meaning that it could variate from having residences, hotels, office space, retail restaurants, recreation, breweries, entertainment, ammenities such as style salons, art galleries, culture centers, science hubs, educational center, show rooms, all interconnected by public space (Calthorpe, 2017). The main difference between mixing uses and creating mixed-use development is the concept of complementing each use with another use, building a sense of community and connectivity, hence, by designing for integration between uses.

Sucessful MUD allow to combine the city culture and historic value, mixing land use and connecting the uses with each other, mixing income neighborhoods, and architecture types while encouraging a walkable and biking environment always close to the public transport means of the city within a ten minute walking distance(UN-Habitat, 2016). Cities that focus in MUD are usually more interested in investing for public transport networks instead of the construction of more inner highways (UN-Habitat, 2019).

A mixed-use development has its own definition from the urban planning, the sustainable, and the real estate perspectives, which will be emphasized within the next sections, to later conduct an analysis on how this type of urban development integrates the concepts of sustainability within the real estate industry, and how it is relevant in ways to create a sustainable future and an attractive pole for investment. Firstly, it is of real importance to deeply understand the meaning of a mixed-use development to not be confused with the concept of mixed land use, also, it is important to consider a SWOT analysis for implementing mixed-use and why it is the future in next decades for city planning.

2.1.1 Design Features

Mixed-use developments are the urban planning strategy opposite from zoning regulations. Such developments play with different uses in shapes and objectives to

create a dynamic connection between the uses and from the users to the uses, it can be mixed horizontally or vertically (Narvaez & Penn, 2016).

- Horizontal Mixed-use developments:

This development creates the mix in uses horizontally within a block or a neighborhood, its great for low rise buildings, and provides the integration of at least two uses mixed per building within a walkable distance from each other, the development doesn't necessarily evolves in one building (Rabianski, 2007).

- Vertical Mixed-use developments:

This type of development takes the major advantage of a site, in terms of land use due to its upwards arise(Rabianski, 2007). There are two main types. Scenario a is a mid or high rise building with the commercial businesses such as restaurants and retail shops at the ground or street level floor, and the rest of the levels above are designated usually for office space, hotels, and residential. The second type is a combination of two or more mid or high rise buildings, typically one for a hotel, another one for office space, and another one for residences, all with commercial use in the bottom levels, integrated by sharing connected walking spaces to each other.

- Horizontal combined with Vertical:

This is the biggest type, trending nowadays specially in zones close to the city business districts(UN-Habitat, 2019). Is the interaction of uses with layers above layers, and blocks after blocks. It usually consists on two or more buildings surrounding a core public space, designed for at least two uses, interconnected with other uses to allow an integrated environment. This projects usually provide space for a future horizontal or vertical expansion. The following figure sets a comon example of this type of mixed-uses within a site.

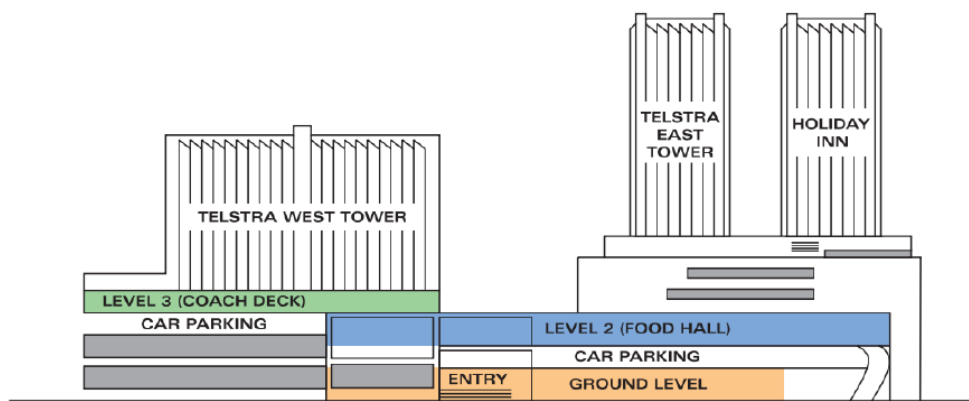


Figure 1. Example of a combined vertical and horizontal mixed-use development.¹

Planning a mix-use development does not only rely on planning the types of uses to be in the project, or to the best balance within the uses, there are key elements that define the smart growth in mixed-use developments, and should always be implemented (Otchere-darko, 2009) for a successful project adding to the global principles of mixed-use neighborhoods.

- Walkability:

One of the main goals is to encourage the pedestrian flow in the design of MUD, by creating walking streets and corridors, the main reason is to create the concept of live-work-play that allows for the users to live in their residence, be able to walk to their jobs, walk to restaurants, do their retail shopping, have recreational time, all within a walking distance. The main goal behind this is to release the need of vehicle dependency, and attract more social network and create the marketing for the customers walking around the area. This not only contributes to healthy living style and clear unpolluted air, but also reduces the traffic congestion, and the need of having an automobile.

¹ The figure is an example from a Sydney Vertical and horizontal MUD (Huston, 2014).

- Transport access (TOD):

The main theory behind MUD is to focus in the site selection for having a walkable distance public transit node, the purpose of traffic oriented developments is to connect the users to the public transport means and biking streets rather than vehicle dependency (Council & Code, 2004).

Changing from vehicle dependency to walkable and public transport lowers the greenhouse gas emissions and the traffic congestions, after all mixed-use developments are designed to host compact spaces with major density levels, so vehicle transit should not be the main means of transport for the users in this development. In some cases a park and ride facility is provided for those users that does not necessarily live in the mixed-use development, but still work and enjoy the amenities of the site (Otchere-darko, 2009). (Council & Code, 2004) describes the ideal design for a traffic oriented development, which allows the users of the mixed-use area to walk within 500 to 1000 meters.

- Open space sharing:

The main feature to connecting uses and buildings are open spaces, there is no ideal mixed-use plan without open space. Open space is the term for walking corridors that allow the pedestrian flow, the elements that invite for social networking, such as benches in a park, the icons for green spaces, the main idea is to use open spaces as pedestrian and bike corridors to allow the users to connect from one use to another just by walking or using their bike (Rabianski, 2007). Open spaces are also a plus to the environment, when a sustainable approach is well designed.

2.1.2 Mixed-use Developments vs Urban Sprawl

While urban sprawl offer the transformation of cheaper land into types of urbanization, promoting cheaper residential or commercial space, it also isolates neighborhoods, and falls into the category of zoning districts, it also has a high reliance in vehicular

transport, and is usually found in the outskirts, or suburbs of a city spreading densification (UN-Habitat, 2016). To the contrary MUD are planned to welcome high density by maximizing space usage, and designing compact areas, while is a new project or a revitalized project, usually the available land in the city centers or district centers is not much, hence, the necessity for creating compacted projects but still allowing to have access to a home, a business, and a variety of services. This section provides a sense on the reason for MUD to respond for population increase and pedestrian friendly environments.

2.1.3 Traditional Single-use vs Mixed-use

- There is nothing wrong with designing traditional single use developments, or living in an area that has them, it all depends on the priorities and desire lifestyle of the users. From the perspective of analyzing only the mixed-use concept, according to the Sustainable Urbanisation Strategy: UNDP's Support to Sustainable, Inclusive and Resilient Cities in the Developing World (UN-Habitat, 2016), the main difference from single-use that mixed-use developments offer are the following:
 - Create densification and efficient urban spaces.
 - Compact developments save expenses on infrastructure such as the building of roads and sewer lines.
 - By generating denser communities, MUD are more valuable than those of single use.
 - Promote walking, and the use of bikes and public transport, which lowers the pollution from traveling in vehicles.
 - Reduces vehicle's traffic congestion.
 - Create successful dynamic environment.
 - Attract more consumers by having different markets around a walkable space.
 - Maximize the use of shared space, for example in a park and ride facility, by night it serves for hotel guests or residential users, and by day to the office, retail, institutional, recreation, and amenities users.
 - Creates a more integrated community.

2.1.4 SWOT Analysis from adopting Mixed-use developments

The following swot analysis is the result from analyzing different case studies and literature review for global standards in mixed-use developments:

<p style="text-align: center;">Strengths</p> <p>Creates social networks. Generates stronger communities by interaction between users from each use Increases confort to the users Allows walkability within a variety of ammenities, recreation, cultural events, educational facilities Designs pedestrian and bike friendly neighborhoods Diminishes vehicle dependency Increases health by promoting walking Increases the capacity to reinent businesses Provides smart city growth Promotes sustainability Lower infrastructure costs Emphasizes the live-work-play concept in a single location Satisfies demand specially for he millenial generations Maximizes the usage of space by sharing common areas at different day time</p>	<p style="text-align: center;">Weaknesses</p> <p>Provides smaller-compacted living spaces. Requires a walkable distance to public transport nodes Is mainly adopted by the long term business Needs encouragement from local authorities</p>
<p style="text-align: center;">Opportunities</p> <p>Attracts pedestrian traffic which creates more business oportunities Contributes to lower pollution by removing vehicle dependency Encourages the use of public transport, bikes, and feet Develops green communities, to enhace health wellness Generates synergy between uses creating a lively atmosphere Increases property tax revenue Reduces sprawl Provides a safer market by balancing the market of one use with another Higher costumer increase promoted by the other uses Allows for less risk in the real estate portafolio Creates value for the site (surroundings, neighborhood) Balances risk between the uses of the development</p>	<p style="text-align: center;">Threats</p> <p>Different users involved, different parties in the development, and real estate.</p>

Figure 2. SWOT Analsis for Mixed-Use Developments ²

² Reference: Own figure.

2.1.5 Contribution of Mixed-use developments in Smart City Growth

Planning mixed-use compounds allow to reach smart city growth by benefiting the society, the environment, and the economy in the following most relevant contributions;

Contribution to the society

- Creates denser and compact spaces, blocks, or neighborhoods.
- Allows people to interact with each other, creating a stronger community.
- Serves as a platform not only for businesses but also for social connections.
- Provides comfort and convenience for the users by having each use reachable within a walkable distance, including public transport.
- Creates a synergy between uses, to provide dynamic and lively communities.
- Ensures greater housing density and variety, reduced distance between uses.
- Designs character that resembles the culture and uniqueness of the city.

Contribution to the environment

The analysis in this section evaluates the benefits in the environment without considering yet the integration of mixed-use developments with sustainable principles, the sustainability approaches are discussed in section 3.2.

- Contributes to greenhouse gas emissions reduction from removing vehicle dependency by creating pedestrian environments and public transport oriented developments.
- Invites to a green community in the public space, providing better air quality and increasing health wellbeing.

Contribution to the market

This section analyses the benefits from mixed-use developments into the economy of a city, not yet talking in a deep sense of real estate benefits, the relation in real estate investment is discussed in section 3.3.

- Increases business opportunities, by mixing uses more pedestrian traffic is attracted around at day and night, creating more opportunities for business, for example for restaurants, shops, and entertainment centers.
- Provides higher property tax revenue
- Balances the market from one use with another for the investors, stabilizing the economy within the development
- Retailers benefit from the other uses living around or on top, this way they will always have customers guaranteed, for example retail shops might be in the ground and first floors of a building, being the main target for the users residing or working on top of their shops.
- The trends for growing cities welcome the local shops to integrate into the mixed-use developments, for two main reasons; the first one is to add value to their products by relocating in a MUD, and the second to contribute in the evolution and innovation by being part on a dynamic environment.

2.1.6 Conclusion of the relevance of Mixed-use Developments

Smart growth allows to benefit from the design of compact and traffic oriented developments such as the mixed-use developments, reflecting in the next summary;

- Mixed-use developments allow to respond for incoming population in cities, and by having transit oriented developments based solely in walkability, biking, and public transport, the environment is benefiting by having less air pollution and lower GHG.
- Welcome the concept of live-work-play, all found in the same site.
- Provide for employment opportunities, and consumer supply-demand.
- Is a perfect response for the demand of housing in city's central districts, surrounded by the needed services and amenities within a walking distance.
- Promotes the switch from vehicle dependency to public transport use.
- Offer a multi-user benefit, by allowing the businesses to benefit from the customers of another use, and viceversa, develop integration within the uses and the users.
- Provide open spaces usually with sustainable principles to reach social networking and environmental goals.

- Allow investors to create less risk by balancing the uses within the development, one use might be financially stronger than the other.
- Allow for old establishments to have a second change by revitalizing them into mixed-use projects to add vitality to the building, the neighborhood, and the city.
- Add value to the neighborhood, therefore create a more attractive economy.

3. Sustainable approaches to Mixed-used Developments

By the year of 2050, 70% of the global population will occupy urbanized land (ICLEI: Local Governments for Sustainability, 2019) meaning that cities will host 70% of the population in the world, here is when the challenge arises; currently cities from all over the world are responsible for 70% of greenhouse gas emissions and 60% of energy consumption (UN-Habitat, 2016), hence the importance to develop a response to that challenge is of immediate need for cities to incorporate a sustainable development.

There are three main goals to be met in a sustainable mixed-use development, the traditional concept is the one that finds balance between environmental, social, and economic aspects, but the sustainable approaches implemented should pair the market needs. The following picture proposes three models for sustainability, in most cases the environmental sustainability might be the biggest circle, this case happens when mixed-use developments are required to go evaluated under a green certification, and as a result, the social and the economic sustainable approaches are met with a little bit of less relevance in the project, but still the three principles should be incorporated in the developments (Wallem, n.d.).



Figure 3. Models for sustainable developments.³

As smart growth icons, mixed-use developments are dependent on adapting sustainable approaches in their planning, and for that there are different global standards that help to create conscience about implementing sustainability in any

³ Source from (ICLEI: Local Governments for Sustainability, 2019)

urban design. Among the most efficient sustainable approaches for international green certification standards are LEED, EDGE, BREEM, and Energy Star. These are the most frequently used sustainable standards for green buildings by providing guidelines on which sustainable principles to adopt to reduce environmental impact, and allow for savings in operational costs.

The most determining sustainable approach to encourage smart city growth are the United Nations Sustainable Development Goals (UN-Habitat, 2016) which analyze different cases all over the world to address sustainable issues and provide with the solutions for cities to adopt in their designs. Some of the most important issues concerning the sustainable goals are developing sustainable cities to ease environmental degradation and global population migration to urban spaces. The sustainable development goal concerning with this research is number 11 "Make cities and human settlements inclusive, safe, resilient and sustainable" (Goals, 2015) which strongly addresses the need for a better planning for urban growth guaranteed with sustainable urbanization. In the sustainable urbanization definition, are the sustainable mixed-use developments.

It is important to quote the United Nations sustainable agenda for 2030, to understand the main need for sustainable developments, which provide critical guidelines to develop sustainable oriented mixed-use. The goal number 11 plans for the following aspects (Goals, 2015):

" 11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.

11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, and children, persons with disabilities and older persons.

11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.

11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage.

11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.

11. a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development, planning

11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels.

11. c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.”

Another sustainable approach is the Eco Districts Protocol (EcoDistricts, 2018) which is a standard for urban and community development that focuses in revitalizing cities and neighborhoods. The protocol is for existing neighborhoods, brownfield sites, business districts, institutions, industrial lands, and mixed-use districts. It collects a compatible sustainable vision an action plan for the parties involved in the projects. The parties involved are mention for the protocol as city officials, community based groupds, real estate developers, financiers, and all major stakeholders (EcoDistricts, 2018). The following figure shows the mechanics behind the protocol for creating sustainbale communities:

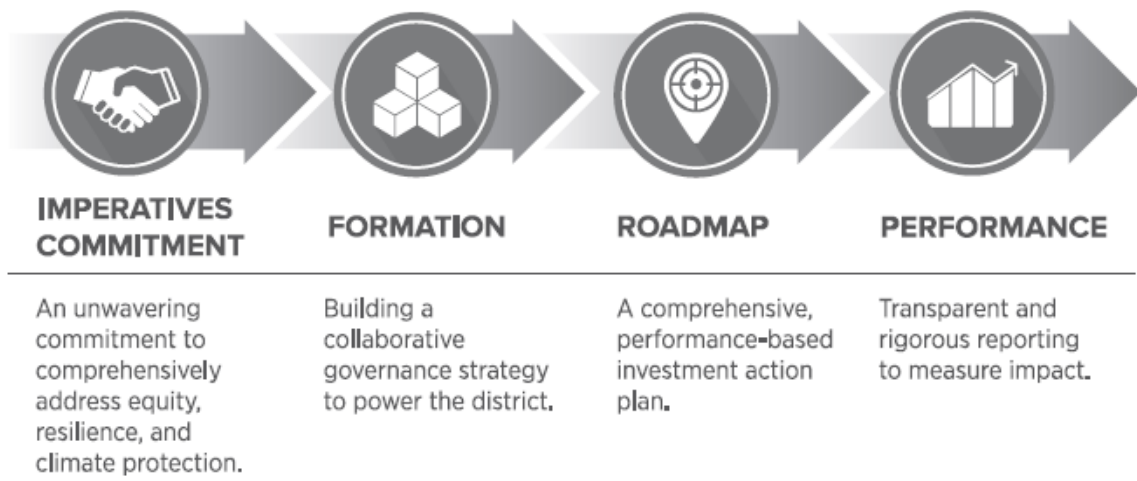


Figure 4. Four areas analyzed by the EcoDistricts Protocol.⁴

⁴ The figure was provided by EcoDistricts (EcoDistricts, 2018).

4. Influence of Mixed-use Developments in Real Estate

4.1.1 Trends in real estate for mixed-use developments.

The current trends in real estate allow to study the changing economy and market demand forecast (Rabianski et al., 2009), the most popular trends studied in the literature review for mixed-use developments in real estate are:

- To satisfy consumer needs by creating mixed-use developments that not just promote the live-work-play concept, but by promoting a fresh live-shop-work-play concept.
- To provide for more walkable mixed-use spaces, as the current markets are milenials and baby boomers adopting public transport instead of vehicle dependency.
- To incorporate a wide portfolio of leisure and entertainment options to complement leasable space.
- To create attractive events in the public spaces to attract pedestrian traffic as means of marketing for the existent facilites.
- Design attratcive spaces within the development, the spaces itselfs are part of the marketing approach because users of one use, are walking by the other uses all the time.

4.1.2. Real estate industries

Private industry in real estate

- The private sector is composed by the real estate developers, real estate investors, coorporate and institutional agencies. Depending on the size of the project it might have a partnership or partnerhips of local and international private investors (EcoDistricts, 2018).

Public industry in real estate

- The public industry is formed by governmental agencies, local authorities, redevelopment agencies, usually the ones in charge of providing the requisites for permitting and allowance of any new urban development. Public investments usually are directed for mixed-use developments that compromise the city market demands (EcoDistricts, 2018).

4.1.3. Real estate benefits from Mix-use developments for the private and public industry.

- By having a mixed-use development, consumers from all the users are integrated within the same development, creating always pedestrian traffic, which increases market benefits (EcoDistricts, 2018).
- Mixing well the uses with walkable lanes in a strategic way for users going to one particular use glance at the other uses, to become costumers of the other uses as well, for example, if someone is going to some shops, might pass by different set of restaurants, and become a new costumer, or a business man going to the office, might become interested in moving to the residence next to the business (Huston, 2014). The key is in the allocation of walkable lanes.
- Private developers usually collaborate with the private industry in order to have a win win benefit, for instance public founding might contribute to the development of cultural or technology facilities while that increases the costumers for the residential or retail spaces (Mouzughi et al., 2014).
- The mixture of private and public industry in real estate allows to increase demand for the real estate properties (Wallem, n.d.).
- Having a mixed portafolio allows the investors to diversify risk, while one use might decline in market demand, the other uses still act as insurance (L. Krause & Bitter, 2012).
- Investments might be high, but having mixed-use developments allow for higher rental prices, which in a long term provide higher returns (L. Krause & Bitter, 2012).

- The variation of uses, allow for the resilience in the variation of the market cycles. Mixed-use developments, allow to maximize user space, leading to take advantage of the sqm for uses that have higher value (Wallem, n.d.).
- Vertical mixed-use developments allow to grow up, and add savngs in land purchases, depending on the local regulations, vertical developments allow for high revenue from a smaller portion of land (Wallem, n.d.).

5. Case Studies

Many case studies came relevant to discuss the help in this research, many sustainable developed countries have a wide range of case studies for mixed-use developments, however not all of them provided the necessary information to get a better understanding of the relevance of such developments connecting with sustainability or mentioning any real estate information. After analyzing different case studies proposed in the beginning from Australia, Hong Kong, Canada, and Emirates, other important case scenarios had a better contribution for this research. At the end the case selection was summarized in a own created database to categorize the analysis by already existing urban-developments, by the suggested principles for green space and sustainability, by the impact in the real estate, and by the relevance of site selection and market analysis. Five case studies are summarized as follows.

5.1. The Atlantic Wharf



Figure 5. The Atlantic Wharf Project.⁵

Project Overview: The Atlantic Wharf is a famous case study to analyze sustainable Mixed-use developments and the influence in real estate. The project is an example of the importance of implementing sustainability in Real Estate properties, the following information of the case study is provided by its developer; Boston Properties (Boston Properties, 2011).

Location: Atlantic Warf, Boston, USA.

Mixed-use includes: the vertical MUD integrates office, residential, commercial, interior and exterior public space, and underground parking, ground floor is for retail and gastronomy.

⁵ Picture obtained from Boston Properties (Boston Properties, 2011)

Description: The Atlantic Wharf mixed-use development had to obtain permitting for preserving the existent 1700's Russia building and revitalizing it for a mixed-use building. At street level the building exteriors remained the same in order to preserve historic value. The levels above had a modern design.

Strategic features: Integrates historic value with modern architecture in a vertical mixed-use development at Boston's waterfront. Revitalization happened by the conversion of residential spaces into office space, and the first floor into commercial space.

Transport proximities: Within less than half a km there are two main subway stations, it provides walkable access to the Harborwalk.

Sustainable achievements: Silver LEED Certified. Among the main LEED features, it has a rainwater harvesting system, the system catches and cleans rain water to reuse it. It has a grid based green roof with local plant species, and the materials used in the revitalization have 30% of recycled materials, such as reused steel, block, brick, and concrete from demolished sites. In comparison to nearby office spaces, the Atlantic wharf is able to save up to 42% in energy consumption by

Investors and Contractors: Developer-Boston Properties (Private real estate investment trust leading the United States). Design- Halvorson Design Partnership, CBT Architects.

Investment strategy: By providing sustainable spaces, the Atlantic Wharf was able to lease 100% of the development within the first year after it opened, even though it charged the highest rents in Boston.

Total Value: 280 Million USD.

Size: 27.5 Acres.

Year of Purchase: 2007

Completion: 2011

Influence of implementing sustainable principles in the development: According to Boston properties (Boston Properties, 2011), LEED certified buildings can ask in the market for higher rental rates in a 7.4% more, LEED buildings also have a higher selling value than non-lead buildings. The LEED principles applied in the Wharf allow for 1.5 million per year savings in utility services operating cost, and in comparison with the non-lead building of the same size and features, energy cost drops from 4 USD per sq.

To 2.59 and water costs from .25 UDS to .08 UDS per sq. These values are merely shown for the purpose of having the idea on how the droppings in cost were obtained by using LEED principles, the prices were obtained back in 2011.

5.2. Songdo, South Korea



Figure 6. Songdo Project in South Korea.⁶

Project Overview: According to the Songdo case study (Whitman, 2017) is not just an example of a mixed-use development, it is also an example of a sustainable urban model that responds to the rapid population increase in South Korea, the City was created from scratch, but the main focus here is how it integrates the sustainability principles in a mixed-use environment. It is a solution for an overly populated city like Seoul.

Location: 65 km from Seoul

⁶ Image obtained from (Whitman, 2017).

Mixed-use includes: residential, commercial, hospitals, institutional, recreational,

Target group: the population not able to reside in Seoul.

Target market: Seoul and national citizens looking for greener environments and an escape from overpopulated cities.

Transport proximities: Songdo has developed interconnected streets that allow the concept for work-play-live having as a rule a public transport stop every kilometer, the city highly relies mainly in biking and public transport, fuel vehicles are not allowed, and mobility is being encouraged. It has 25 km of bike lanes connecting to a 145 km city circuit.

Sustainable achievements: at least 80% of the buildings are LEED certified, aiming to have the rest of the buildings also certified. LEED certified buildings have water reuse by stormwater collection in tanks to reuse for irrigation and in office space is reused for the sewage. This allows for a 40% water savings. Songdo uses renewable energy, everything is designed with energy efficiency icons. The city has a line based waste system, and the use of fuel vehicles is forbidden. It is designed to be one of the top sustainable cities. 40% of the city area is dedicated for green open spaces, and 95% of parking is below street level. Green roofs are also a normal roof built model.

Investors and Contractors: A large list of global partners.

Total Value: not mentioned.

Size: 30.5 Million sqm with 40% dedicated to green space.

Year of Completion: 2020

5.3. The Exchange, Ghana



Figure 7. The Exchange MUD, Ghana.⁷

The Exchange is the largest mixed-use development project in West Africa, the following information was obtained from the project data at the Exchange project website and public videos (Forewin group & Actis LLP, 2016). The Exchange is a response for the local and international markets. The overall render can be found in Appendix A.

Project Overview:

Location: Accra city center, Ghana.

Mixed-use includes: multi complex project, with a 4 star Radisson Blue hotel for business, conference rooms, two office blocks, underground parking, 12,000 sqm of retail including a shopping area with high street shopping mall with large international malls, a fitness facility and supermarket at the top level, 500 sqm for children playground, and restaurants for gourmet and fast food. It also includes private 1, 2, 3 bedroom residences and penthouses with access to the whole multi complex project.

Target group: multi-age destination, provides an offer for all ages.

Target market: local population and international guests for tourism or business.

⁷ Picture obtained from The Exchange Project website (Forewin group & Actis LLP, 2016).

Description: is a place for leisure, for business, and a destination for the city of Accra.

Strategic features: the project is operated with local workforce, and designed with the features of the local environment to maintain historical heritage. The project wraps a getaway feeling from the city even though is at the heart of the city.

Transport proximities: proximity to the airport.

Sustainable achievements: savings of 20% in energy and water usage, completion of the EDGE Certificate (Excellence in design for greater efficiencies), all the landscape reflects the culture of the city of Accra. International standard development.

Investors and Contractors: Actis LLP, Forewin Group, Hok, MSF Construction, Profica, Holdings Ghana, Farrow Laing, Dar.

Investment strategy: International private equity funds, brings in an international hotel group, the Radisson Blue. Long time investor Actis LLP in partnership with the Forewin group led the project, by promoting the projects, a list of international investors started to participate within the different uses of the project. Investors have variety in their portfolio. By creating a partnership, the partners put 100% equity to secure the construction of the project until the end and was capitalized by World Bank and GTB. Is capitalized by international and local banks. Subcontractors are local.

Total Value: 150 Million USD

Size: 60,000 sqm

Year of Completion: 2018

5.4. Southern Überseequartier, HafenCity

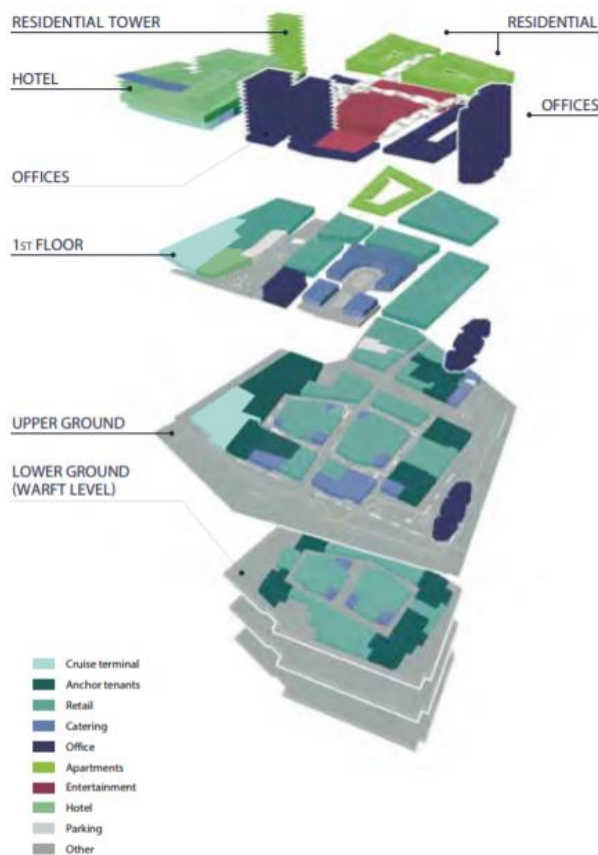


Figure 8. Überseequartier, Hafen City explained by Uses.⁸

According to the HafenCity project report to the public (HafenCity, 2017), this mixed-use development is another side project towards the full development of HafenCity inside the City of Hamburg, the development consists of the following. A great layout to understand the mixed-use concept is displayed in appendix A.

Project Overview:

Location: Center of HafenCity, Hamburg Southern bank quarter.

Mixed-use includes: A total of 11 buildings interconnected in the lower floors. In gross floor area it counts with 94,000 sqm for retail, 97,000 sqm for Offices, 123,000 sqm for

⁸ Figure obtained from the HafenCity project website (HafenCity, 2017).

residential, 14,000 for culture and entertainment, 55,000 for a hotel, 16,000 for catering, and 8,000 for a cruise terminal.

Target group: multi age.

Target market: tourists, incoming population, and Hamburg residents as well as the users operating in the different uses.

Strategic features: integrating the cruise passenger terminal, underground bus station, parking lot, and taxi stands with the other mixed-use concepts. It will have large dimension window frontage in the first floors with access only from the basements to avoid the concept of a shopping mall.

Transport proximities: cruise terminal, bus terminal, parking place, and subway lines within a walkable distance.

Sustainable achievements: it is an engineering design in alignment to cope with weather features, has natural ventilation encouraged by open areas and the open design of the project. The floor space is dedicated to private builders having the right of way, and the ground floor will remain as an open area. Designed to achieve the Gold HafenCity Ecolabel and BREEAM Excellent Standard.

Investors and Contractors: Not mentioned.

Design: Christian de Portzamparc, UNStudio, Carsten Roth, Léonwohlhage, kbnk, Hild und K, Böge Lindner K2, Lederer Ragnarsdóttir Oei, Saguez & Partners, Walter Sobek.

Investment strategy: Growing in the construction of all uses, demands for higher investment and businesses ready to move into the new development looking for more quality and demand for their services, is a place that will have it all.

Total Value: EUR 960 Million.

Size: 410,000 sqm.

Year of Completion: 2021

5.5. Four Frankfurt, Frankfurt Main



Figure 9. FOUR Frankfurt MUD, Germany.⁹

The Deutsche Bank area in Frankfurt city center is projected to switch from being a bank district into a diverse district to create work, living, and public space. By creating a mixed-use space, the site regains vitality and diversity instead of being a single-use quarter while preserving its local heritage (4Four, 2019). Appendix A displays a picture of the aimed development.

Project Overview:

Location: Frankfurt Main City Center.

Mixed-use includes: Horizontal and vertical (mainly vertical) mixed-use neighborhood, counting with two residential towers, 600 apartments, and two hotels. Some of the data provided include 6,315 sqm for infrastructure, 16,840 sqm for retail and eateries, 92,620 sqm for residential, 94,725 sqm for office space. Among the provided amenities are kindergarten, health centers, retail, and public space such as space for events, sports, and recreation.

Target group: multi age groups.

Target market: City of Frankfurt and international public.

⁹ Picture extracted from the FOUR Frankfurt Project website (4Four, 2019).

Description: Is a new neighborhood for the locals and tourists, has hotels, leisure, residence, commercial, and office space.

Strategic features: Revitalizing an existent site, switching from a single-use quarter to a mixed-use one. Creating walking routes that connect to the surrounding neighborhoods. The site is open day and night by combining the different functions within the development. Adds walkable passages in existing blocks to connect the squares between the mixing uses and existent buildings by incorporating amenities and public space.

Transport proximities: within walkable short distances to public transport.

Sustainable achievements: The design integrates into the structure of the City center, keeping the local structure type. Sustainable, lively and international development including green islands.

Investors and Contractors: Groß & Partner real estate Development Company in Germany. Their portfolio includes residential, commercial, hotels, and urban planning.

Masterplan: UNStudio.

Design and execution: ARGE UNS + HPP.

Investment strategy:

Total Value: Not mentioned.

Size: 219,000 sqm.

Year of Completion: 2023

Key characteristics: BIM project with the use of a common standard.

5.6. Analysis and Conclusions from the Case Studies.

For instance the Exchange, in Ghana case study demonstrates how developing countries can embrace their cultural and historical value to create sustainable communities by reaching international investment. Also it explains how an initial concept in the design and planning phases created the marketing for coming investors, to be able to create partnerships and have a hundred percent equity to be able to secure the completion of the project until its final stage, and also explains other scenarios on how half percent equity is available but how the presales of the property help to finish the construction works, mainly by balancing the cost and revenue at each phase.

The situation that happened in the Atlantic wharf is a clear example on how city centers have a future, a second chance to become usable, and sustainable, it shows that by applying sustainable guidelines such as LEED certification, the building itself gains more present value, and significantly reduces operational cost by at least half percent compared to those mixed-use developments without any green certification. This case also shows the possibilities of preserving a historic central district, or downtown while incorporating modern designs above street level, and revitalizing the development with mixed-use principles, attracting more costumers and pedestrian flow in the area.

The case study from Songdo in South Korea might be a massive mixed-use development, because it provides the aspects to consider when building a city from scratch, but what is relevant here is the demonstration of the principles to incorporate when creating sustainable cities, and how overpopulated cities such as Seoul are responding to the extreme demand for living spaces and lack of supply within the same city, in cases when all the resources have been exploded, seems to create a sustainable city with future growth and self-reliant in terms of recycling and reusing seems to be the answer.

The project of FOUR Frankfurt reflects the possibilities of incorporating existent city centers into the construction of new developments, it shows how a single-use bank district that did not provide for any public space around or invited for any other use,

was transformed into a lively neighborhood by connecting existing spaces with new vertical mixed-use developments, offering horizontal mixed use developments to the street level, and high mixed-use buildings to the sky level. Such a significant transformation in the city of Frankfurt is an inspiration mainly for transforming the rest of single-use city centers adding vibrancy and integration in the site.

Lastly, the project happening in Hamburg, at HafenCity is also proof on how existent sites, in this case one of the most important harbors in Europe is being transformed to incorporate mixed-use developments, it provides a sustainable environment in its design mixing the uses and yet providing privacy for all of them.

The common characteristics that the case studies share are prevailing examples on how the future for mixed-use developments relies solely in sustainability certifications, most of them by using international approaches such as EDGE, BREEM, LEED, BOMA, World green building council.

Also, there is the relevant requisite of having or developing public transport nodes in close proximity to the transformed sites, some case studies have even built their own means of public transport, such is the case of HafenCity, developing the cruise terminal, underground bus station, and already connected with the nearby two main subway stations in line U4.

Another aspect to consider is that usually these developments mainly mix residential and office space in comparison to the rest of the uses. It seems to be very important to leave space for incorporating public spaces, and take advantage of them to allocate green space, and allow for integration of the rest of uses with pedestrian passageways.

Most of the case studies propose to have vertical mixed-use developments connected or integrated within the ground floors for open space, and within the street level for commercial and gastronomy spaces. Another common characteristic is the integration

of the actual development with the blocks or neighborhoods surrounding it, by designing bike lanes and walking streets. And finally, the main findings to add relevance for the purpose and research questions in this thesis, is the connection in the planning of sustainable mixed-use developments with remarkable benefits in the real estate industry, which allows for this research to be explored. The next sections talk about the strategies of that integration.

6. Guidelines to determine the feasibility of Mixed-used Developments

There are different international principles to help in determining the feasibility studies for mixed-use developments, for the purpose of this research, after analyzing different scientific literature and case studies, findings of similarities between these principles were found.

This is a general international determining indicators to know whether a MUD will have a positive impact in a community by understanding the guides to approach a suitable site selection, type of mixed-use development, percentages of uses mixed, as well as if it is a possible supply for the demands in the actual and future market (Rabianski, Joseph S., Giblier, Karen M., Alan, 2009). It is important to consider that mixed-use projects respond to long term businesses, and are long term projects, thus, the feasibility analysis is for at least looking ahead into the 25 years after the project is built (UN-Habitat, 2015).

The guidelines have been summarized by their trends for success, categorized into site analysis, market analysis, social and economic analysis. This section does not discuss the feasibility of the design and functionality itself, it focuses in supplying the demands of having such a development in a district within a city.

1. Site Analysis

- The site for the mixed-use development should be strategically chosen to be in two main development concepts: the first in denser areas to provide for the uses being developed, and the second, in areas where the city needs revitalization, or lively re-integration of space.
- MUD are traffic transit oriented, therefore the site location should be within a ten to twelve kilometers distance from any public transit node.

- If the project will not be including the development of public transit means (read the case study for HafenCity) then it should be developed in areas where public transit are suitable for the density of traffic the project will have.
- The site should provide for enough space for the development of safety walking pathways, along with bike lanes, after all MUD have the mission to encourage pedestrian and bike friendly projects, not only within the project itself but also to integrate in its surroundings to connect to provide easy and safety access to other buildings, blocks, or neighborhood. This is relatable to the project size, as it might be a MUD in just one building, a block, or an entire neighborhood (read FOUR Frankfurt case study).
- The site should also be fitted to provide for open areas, open areas are a key element for this specific developments because the whole integration of the project itself and with the surroundings depends on the connectivity provided by open areas, which are usually the walkable passages, shared public spaces between uses, and green spaces.
- Is the site supported by the local authorities? Does it allow for a mixed-use zone, does it provide enough infrastructure, does it require to preserve historical value, or revitalize an isolated or single-use area?

2. Market Analysis

- Which are the demands from the market within a city, a neighborhood, a district?
- MUD should be planned to address population increase, and the target groups can fluctuate from the local rising population density to the floating population, business related incoming population, or tourists looking

for a temporary destination (in case of having hotels or being in an international business nest) (refer for example to the case study in Ghana).

- The growing population age is a key factor, for example internationally speaking the nowadays millennial generation has trends to live in city business districts, on depending on public means of transport, of being ecological and being bikers, have the desire for living in compacted spaces even if the rent is high as long as it provides for amenities nearby and a walking distance to their jobs. Nowadays and for the next decades millennials are being the stronger market for mixed-use developments.
- Is the demand for housing and commercial space not keeping up with the existent supply? How much needed is a project with multi use functionality in a specific site?
- Large MUD usually look for enough space to allow the project to keep expanding in the future. Hudson Bay in New York City is a clear and strategic example of it.

3. Social Analysis

- The main concept behind MUD is the live-work-play. Is the project based in these three connected principles? Mixed-use development should facilitate the user access to the residence, work or institution, and entertainment or cultural spaces within a walking distance, depending on the uses being involved.
- The development should provide strong social networking by the way the uses interphase with each other, also public space should provide for amenities to allow social interaction.

- Is the development connecting the user with the development fabric? For example, if it has a facility for senior housing, and the use provides night-life around it, it does not make much sense for the project to be attractive.

4. Economic Analysis

- The use occupying the highest space should be the use that is financially stronger, not the one that will sell faster, but the one that has the higher revenue from the project.
- The idea behind mixed-use developments is a key combination of the uses to balance each other and make each other valuable assets. For instance, a single-use development might not have the same value as a mixed-use development where the market for a specific use suits perfect for the market of the other use.
- Mixed-use developments tend to provide higher value than single-use.
- Is the development going to increase the land prices on itself and around?
- The development should have the fastest absorption at the highest price to be successful.
- Economic success relies deeply on planning for the adequate mix to build faster what needs to be sold or leased the project.
- Partnerships usually allow to have 100 % equity to secure the completion of the project.
- The economic success depends on the ability of mixing the uses in a hierarchy that responds to the market opportunities and supply the demands.

- Discounted cash flow IRR analysis and real estate proforma are the best tools to conduct a deep economic feasibility for the project. Nowadays there are software and even mobile applications that provide the calculations faster and more accurate.
- The development needs to achieve an integrated approach, each use is providing a service for the other use, and a balanced synergy is a key for success from the uses in order to increase the investment value and market value. For example, retail benefits from the residential use, residential benefit from the office use, office benefits from retail, hotels benefit from the business visitors and restaurants from the hotels, and the chain goes on.
- Whether is for supplying for the demand, or revitalizing a district, is important to consider to address the demand using the development and the incoming attraction of additional existing or developing projects.
- Always look into the future statistics for demand.

The mentioned feasibility guidelines are not providing for sustainable solutions, impact in the real estate market, the following section, integrates these two concepts into mixed-use developments and provides the relevance on how these developments are the solution for addressing population increase, impact on climate change, and city revitalization.

7. Strategic trends to integrate Sustainability in Real Estate for mixed-use developments

The most frequent conceived idea when talking about sustainability and real estate in the same sentence tends to be rejected. Investing a project with a green certification automatically warns for higher initial costs, and then the idea of developing such projects collapses. The main focus on this research is to provide trending strategies in the market that allow successful projects to be sustainable and of real value for the real estate industry. After all, the future for urban development is already requiring an international and local levels of sustainability in their projects for sustainable cities and smart growth, besides in projects like this, long term projects, the whole financial cycle should be analyzed in a cost benefit relation (UN-Habitat, 2019).

“While the far-reaching advantages of constructing sustainable mixed-use developments have already been established especially in terms of societal, economic, and human development, smart cities are also becoming a popular concept in the real estate market. Apparently, the construction of such developments has possibly evolutionary consequences for the real estate business, as this can boost the real estate market, add value to properties, and thus exponentially increase profit yields, consumer trust, and fierce market competition”(Wallem, n.d.)

Therefore the concluding relevant strategies for creating a bound between sustainable developments and real estate are the present need and will keep being the need for the future. Here are the proposed strategies to achieve a sustainable mixed-use development in real estate.

- Incorporate mechanisms that allow recycling of waste, of water, and assets within the uses of the mixed-use.
- Incorporate comprehensive sustainable approaches mainly to achieve water and energy savings.

- Include green roofs, blue roofs, and infiltration basins that perform as a storm-water management systems to reduce operation water costs.
- Adopt rainwater harvesting for reuse to use the water for irrigation and for sewage facilities.
- Encourage the user's physical activity, socialization, and air quality by emphasizing walkable corridors and passageways to integrate the different uses within the development. A well designed network of pedestrian and bike flow is what allows to have successful mixed-use developments by allowing connectivity and networking of uses for the users.
- Take advantage of developing transit oriented developments and incorporate emobility systems and reduce vehicle dependency to lower greenhouse gas emissions.
- Mixed-use developments are compacted designs to respond as high density solutions, therefore by using energy efficient features, cost in operational savings are greatly reduced.
- Find the local strategic development plan to supply for the incoming years' markets demands and based on site location, have the right mixture in the uses to be developed.
- Follow international green certifications to implement in the development, studies have shown that green certified buildings add greater economic benefits in which water and energy cost savings are reflected.

- Determine pricing premiums by having sustainable developments, if the demand allows them to have less risk. In the long term green buildings have the ability to generate higher operating income.
- Conduct an analysis on the sustainability performance to have a forecast for future risks and opportunities.
- Rely on real estate proforma to calculate the correct mix depending on the desired cash flow analysis.
- Create financial incentives that promote sustainability.
- By having green developments, returns are improved and future value of real estate investments.
- Not just implement green standards, aim to have a green certificate to ensure the asset value increase.
- By adopting sustainable developments the decisions made today always have positive consequences on tomorrow's events, in terms of sustainability the next years requirements will become more strict, so this is always a great initiative for investment and provides more attractive projects for the market because awareness on sustainable solutions for city growth is becoming more obvious and also lenders, tenants, and buyers are requesting sustainable approaches in the developments.
- Create a balance of sustainable quality to satisfy both, the investors and tenant demands.
- Higher green certification, higher rental values.

- By adopting sustainable trends, the value of sustainability investment attracts other investors, leaving space for creating partnerships to support the project.

As a conclusion of this section, regardless the sustainability trend integrated in mixed-use real estate, having green certification is becoming part of common designs, as city strategies for the next decade are not recommending, but requiring to have green certification in the coming urban projects. Mixed-use developments are already sustainable for promoting walkability and lowering greenhouse gas emissions, as the design encourages the total dependency in public transport, bikes, and feet. Overall, the market is transitioning for a sustainable demand in real estate properties. An ideal sustainable piece of real estate is shown in the following figure:



Figure 10. Sustainable MUD.¹⁰

¹⁰ Sustainable mixed-use model proposed by (GRESB, 2020).

8. Are sustainable Mixed-used Developments the future for Mexico City and Berlin?

This section is taken as a practice exercise to analyze the real estate market demands, the population increase, demographic information, urban strategic plans 2030, with the main objectives of determining if the future relies on mixed-use developments for both cities, and if that is not the case, to find the challenges of the cities by incorporating sustainable mixed-use developments, trends, and urban future planning, as well as further possible research required. The following figure shows the world population growth by country.

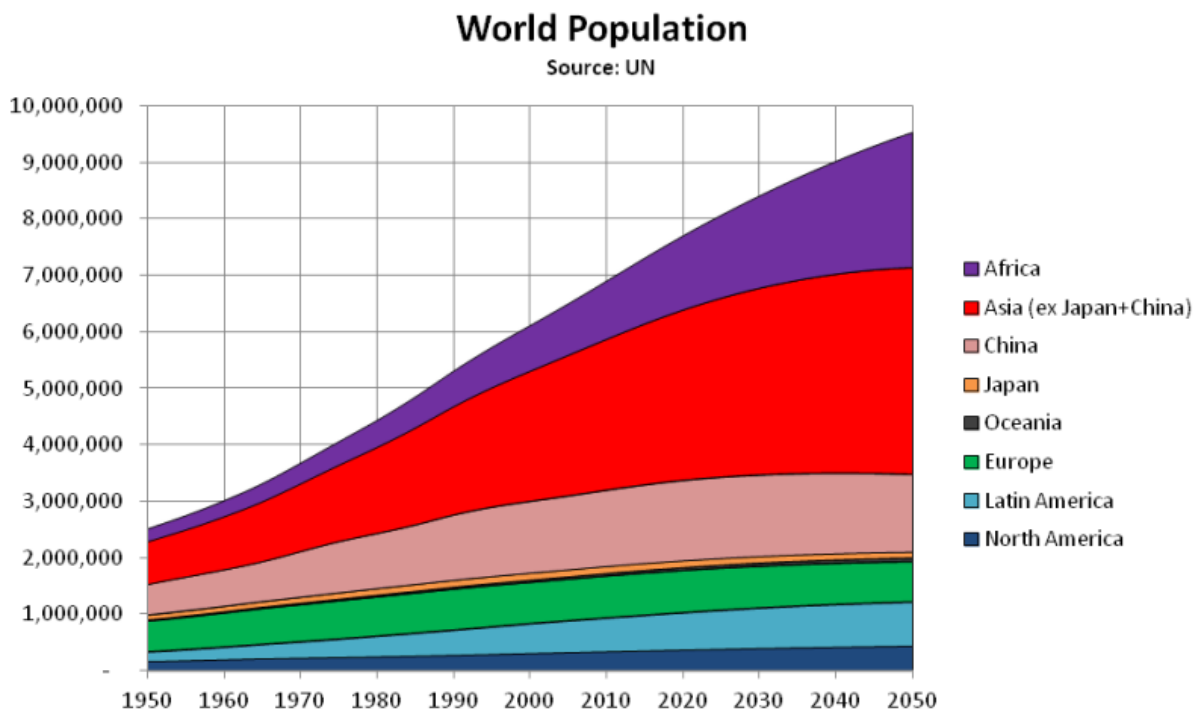


Figure 11. World population growth by country by decade.¹¹

¹¹ Source (United Nations, 2017).

Results of evaluating the proposed strategies in both Cities, does the supply fit the demand?

The urban strategic plans, demographics, and local sustainable principles in both cities indicate the need to incorporate mixed-use developments mainly aiming to residential, commercial, scientific and technological uses. The trends to be incorporated are energy efficient developments, water management systems, solar energy, and besides the normal walking and bike lanes that the usual mixed-use models requires, the trend to bloom in the next years is the mixed-use space connecting neighborhoods by mobility systems (Senate Department for Urban Development and the Environment, 2015)(4S, 2018). The research and trials are already developing in both cities, but the total incorporation of mobility has not been achieved yet.

The relevance of conducting a urban analysis for potential mixed-use developments in Mexico and Berlin, was to understand that MUD are being popular again, and are the solution for the increase demand of population and to lower environmental impact, while Berlin has a deficit in the supply for the demand in housing, Mexico city has a deficit to managing vehicle dependency, and even though Mexico has built more mixed-use developments than Berlin (Industria & Grupo, 2016), it is still a city facing high greenhouse emissions, high energy waste, and high traffic congestion, yet the city has not given up in continue with the development of infrastructure for public transport means that complement the existing and future mixed-use projects.

Another aspect is that while Mexico is still a developing country, it is requiring LEED certifications in all the mixed-use developments (4S, n.d.), and since it is a city with shortage in land use, all the mixed-use developments are vertically shaped (4S, 2019a), while in Berlin the existent and planned development are low to mid rise shaped focusing more into the integration of blocks and neighborhoods (Guthmann, n.d.).

9. Conclusion

To successfully conclude this research it is important to have responses for the research questions proposed in the beginning, the following are the research questions with their respective answer.

1. Are smart growth icons, mixed-use developments, and the real solution for on-going growing cities such as Berlin and Mexico City?

While the globe faces many challenges of a continuous population growth and climate change, the cities face the challenge for having a strategic planning to cope with that population increase and environmental degradation. According to the global principles of building better cities, (Calthorpe, 2017), a resolution to unravel climate change is reliant on how the cities are planned, if a city is strategically planned, not only it will provide for environmental impacts, but it will also reflect enhancement in social well-being and economic endurance. These global principles also indicate that the main challenges nowadays with city planning is Sprawl.

Urban sprawl mainly relies on vehicle transport for the population migrating to the outer skirts of a city where density is less, and urbanization has not been strategically designed (UN-Habitat, 2015). In other words, sprawl is the opposite of having a structured plan for a city's urban development. Among the many consequences of a city with urban sprawl are that it isolates blocks, it creates lack of integration between and among districts, it does not connect the society, and it provokes segregation in the economic, environmental, and social principles of the population. A city is then well integrated and vibrant when it has interaction in its urban planning, allowing society to grow (Calthorpe, 2017).

How can a city embrace smart growth through the next decades? When a City grows smartly, it has a blooming effect in the environment, society, and economy. Smart growth is then a theory that generates resilient cities with a city planning that produces the opposite of urban sprawl. Smart growth encourages

the cities by adapting to climate change with coping strategies and to rely on public transport by creating transit oriented developments, it also creates pedestrian and bike friendly neighborhoods, and it integrates the city's districts in a more compacted version instead of expanding and provoking urban sprawl, hence smart growth creates a sense of community by creating mixed-use environments with quality of life (Sackey, 2009).

With that in mind, mixed-use developments address solutions to reduce greenhouse emissions in over polluted cities such is the case of Mexico City, and retain urban sprawl for growing, also by planning cities with more mixed-use development there is a more integrated society, highly depending on public transport, which is a plus in the case of Berlin, that has a well-structured and connected public transport. Also, as a response for growing cities due to population increase, mixed-use developments have the advantage of having vertical models to fit in cities where the land use is restricted, which is the case of Mexico City. In the case of Berlin, mixed-use developments respond to the market demands mostly by mixing residential, and office space. In both cities, regarding the country's economy, a mixed-use development is a proposal to consider.

2. How to integrate affording sustainability with real estate revenue?

Having a mixed portfolio allows the investors to diversify risk, while one use might decline in market demand, the other uses still act as insurance. Investments might be high, but having mixed-use developments allow for higher rental prices, which in a long term provide higher returns.

Often cases, it has been studied that adding green certification adds more value to mixed-use developments, which already have more value in the market than those of single-use. And in the long term savings up to 50% are possible in the operational cost for the utilities mainly by using energy efficient, water harvesting, and reuse and recycle sustainable approaches.

The most frequent conceived idea when talking about sustainability and real estate in the same sentence tends to be rejected. Investing a project with a

green certification automatically warns for higher initial costs, and then the idea of developing such projects collapses. The main focus on this research is to provide trending strategies in the market that allow successful projects to be sustainable and of real value for the real estate industry. After all, the future for urban development is already requiring an international and local levels of sustainability in their projects for sustainable cities and smart growth, besides in projects like this, long term projects, the whole financial cycle should be analyzed in a cost benefit relation (UN-Habitat, 2019).

Therefore the concluding relevant strategies for creating a bound between sustainable developments and real estate are the present need and will keep being the need for the future.

3. Who wins more by creating sustainable mixed-use developments, the private or the public industry?

In the beginning of this study, I was not completely sure how the real market operated in the relation of investors and developers from both industries, but after conducting an extensive literature review from past and future investment trends for mixed-use, often cases is a win-win situation, mostly by creating partnerships, or having the support of public founding while the services are provided by the private industries.

Usually in a mixed-use project both parties are somehow involved, since this projects are usually to revitalize a district in the city center, that has historical and cultural value with some local limitations, or are new developments that require breaking the restrictions and creating a new model for the city plans, it all depends in the local and national authorities. As seen in the case studies, often is the case that the world bank works in cooperation with the local banks to still preserve a sense of the local community into the project, and from the case studies, it is noticeable how frequent international developers are the ones conducting mixed-use developments in partnership with the local public industry.

4. Which guidelines are to consider to determine a mixed-use development, is it feasible?

The guidelines were categorized into four, site, market, social, and economic analysis, the environmental analysis is relevant when determining the market demand and site selection.

Site Analysis

- The site for the mixed-use development should be strategically chosen to be in two main development concepts: the first in denser areas to provide for the uses being developed, and the second, in areas where the city needs revitalization, or lively re-integration of space.
- MUD are traffic transit oriented, therefore the site location should be within a ten to twelve kilometers distance from any public transit node.
- If the project will not be including the development of public transit means (read the case study for HafenCity) then it should be developed in areas where public transit are suitable for the density of traffic the project will have.
- The site should provide for enough space for the development of safety walking pathways, along with bike lanes, after all MUD have the mission to encourage pedestrian and bike friendly projects, not only within the project itself but also to integrate in its surroundings to connect to provide easy and safety access to other buildings, blocks, or neighborhood. This is relatable to the project size, as it might be a MUD in just one building, a block, or an entire neighborhood (read FOUR Frankfurt case study).
- The site should also be fitted to provide for open areas, open areas are a key element for this specific developments because the whole integration of the project itself and with the surroundings depends on the connectivity provided by open areas, which are usually the walkable passages, shared public spaces between uses, and green spaces.

- Is the site supported by the local authorities? Does it allow for a mixed-use zone, does it provide enough infrastructure, does it require to preserve historical value, or revitalize an isolated or single-use area?

Market Analysis

- Which are the demands from the market within a city, a neighborhood, a district?
- MUD should be planned to address population increase, and the target groups can fluctuate from the local rising population density to the floating population, business related incoming population, or tourists looking for a temporary destination (in case of having hotels or being in an international business nest) (refer for example to the case study in Ghana).
- The growing population age is a key factor, for example internationally speaking the nowadays millennial generation has trends to live in city business districts, on depending on public means of transport, of being ecological and being bikers, have the desire for living in compacted spaces even if the rent is high as long as it provides for amenities nearby and a walking distance to their jobs. Nowadays and for the next decades millennials are being the stronger market for mixed-use developments.
- Is the demand for housing and commercial space not keeping up with the existent supply? How much needed is a project with multi use functionality in a specific site?
- Large MUD usually look for enough space to allow the project to keep expanding in the future. Hudson Bay in New York City is a clear and strategic example of it.

Social Analysis

- The main concept behind MUD is the live-work-play. Is the project based in these three connected principles? Mixed-use development should facilitate the user access to the residence, work or institution, and entertainment or cultural spaces within a walking distance, depending on the uses being involved.
- The development should provide strong social networking by the way the uses interphase with each other, also public space should provide for amenities to allow social interaction.
- Is the development connecting the user with the development fabric? For example, if it has a facility for senior housing, and the use provides night-life around it, it does not make much sense for the project to be attractive.

Economic Analysis

- The use occupying the highest space should be the use that is financially stronger, not the one that will sell faster, but the one that has the higher revenue from the project.
- The idea behind mixed-use developments is a key combination of the uses to balance each other and make each other valuable assets. For instance, a single-use development might not have the same value as a mixed-use development where the market for a specific use suits perfect for the market of the other use.
- Mixed-use developments tend to provide higher value than single-use.
- Is the development going to increase the land prices on itself and around?

- The development should have the fastest absorption at the highest price to be successful.
- Economic success relies deeply on planning for the adequate mix to build faster what needs to be sold or leased the project.
- Partnerships usually allow to have 100 % equity to secure the completion of the project.
- The economic success depends on the ability of mixing the uses in a hierarchy that responds to the market opportunities and supply the demands.
- Discounted cash flow IRR analysis and real estate proforma are the best tools to conduct a deep economic feasibility for the project. Nowadays there are software and even mobile applications that provide the calculations faster and more accurate.
- The development needs to achieve an integrated approach, each use is providing a service for the other use, and a balanced synergy is a key for success from the uses in order to increase the investment value and market value. For example, retail benefits from the residential use, residential benefit from the office use, office benefits from retail, hotels benefit from the business visitors and restaurants from the hotels, and the chain goes on.
- Whether is for supplying for the demand, or revitalizing a district, is important to consider to address the demand using the development and the incoming attraction of additional existing or developing projects.
- Always look into the future statistics for demand.

5. Which are the guidelines for closing the gap between sustainable mixed-use construction and real estate?

The guidelines/strategies can be found in Chapter 7.

10. Discussion

There is a wide gap of missing information into how to close the gap in the integration of sustainable strategies for successful real estate in mixed-use developments, however that was the goal of this research, to find the strategies and close the gap, the perspective of perceiving sustainable developments are far away from reality in terms of being a trend in the real estate industry was never conceived until after the extensive study of the topics and critical thinking of different case studies not even mentioned in this thesis. The main highlight is that buildings green certification is becoming a requirement for future developments, which leads not choice but to the real estate to keep up, which after all allows to diversify risk of failure and balances the uses operational cost savings, while is already a benefit for the different uses to promote each other in the high pedestrian traffic that the MUD provide.

Calling for future research in the mixed-use development topic, I suggest the research of using virtual reality as a tool for investors to understand not just by financial analysis but also by envisioning the projects in a real world feeling, diversifying virtual reality in different real estate technologies, would be a great tool for upcoming developments. Another topic is the co-living spaces inside a mixed-use development, in the future private properties might have to share also residential spaces and facilities to maximize space usage and reduce wastage of individual resources, and contribute to social and environmental sustainable properties.

Declaration of Authorship

I hereby declare that the attached Master's thesis was completed independently and without the prohibited assistance of third parties, and that no sources or assistance were used other than those listed. All passages whose content or wording originates from another publication have been marked as such. Neither this thesis nor any variant of it has previously been submitted to an examining authority or published.

Location, Date

Signature of the student

Appendix A

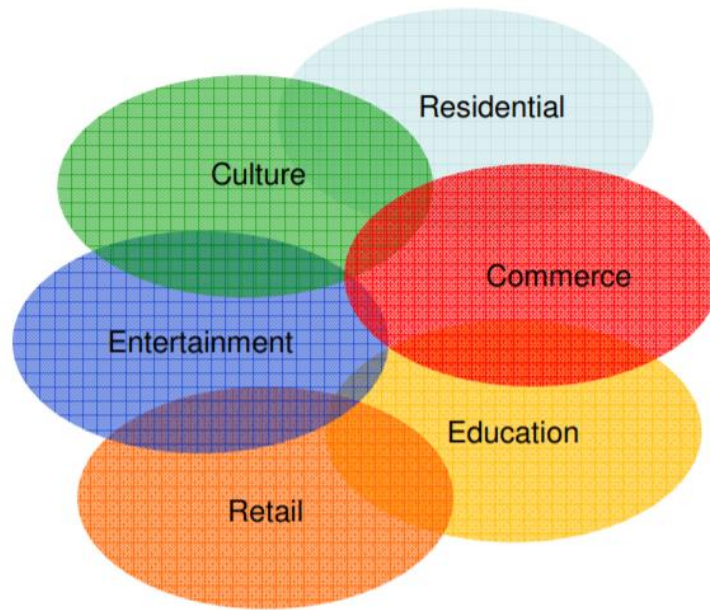


Figure 12. Synergies behind the Mixed-use concept. ¹²

¹² Figure obtained from the synergies in MUD. (Whitman, 2017).

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