"Buying the Air" – Planning and Land Policy Interventions for Hybrid High-Rises in Frankfurt am Main

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Frankfurt am Main is well-known for its financial centre of Europe and recognised as the German city with the highest concentration of high-rise buildings ("skyline"). For several years now, this construction class has also been discovered for hotel, residential and hybrid usages. After the events of 9/11, high-rise construction came to a standstill worldwide. Which domestic and international developer would want to build the highest high-rise as an investment landmark in a city? Instead, smaller residential towers at a height of 60–80 m were preferred by investors. Twenty years later, the completion of an initial 15 hybrid-use high-rise towers in the city of Frankfurt am Main is expected by the year 2023. Other German cities such as Berlin, Hamburg and Dusseldorf are following similar strategies to implement vertical allocations of property rights in towers embedded in selected privately owned (semi-)public spaces. The amenities include arcades, pocket parks, seating areas, landscape terraces, rooftop bars and swimming pools. We will discuss the renaissance of high-rises, which is a market-based and marketing-based approach following the monetary policy of the European Central Bank, wooing investors at a time of unprecedented speed of construction of tall, particularly hybrid, buildings. In the case study of the 'Four' inner-city revitalisation project, located on plots formerly known as 'the forbidden town' of Frankfurt as this area was blocked to the public for decades, we will pay particular attention to the planning department's right to regulate. The findings presented here are the result of scientific project work conducted in 2019–2020. The local government has imposed a 30% mandatory quota for affordable, subsidised housing rents and price reduced condominiums as legally binding requirements for tower constructions to prevent vertical gated communities. Our essay deals with the central areas of real estate development: land and capital investment.

Fig. 1: High-rise project "Four". (Source: Groß & Partner 2019)

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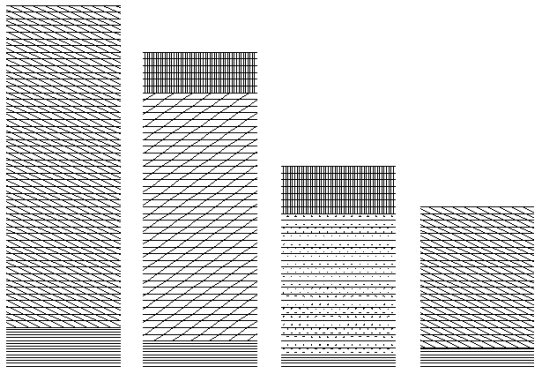
1 Case study: The "forbidden town"

In May 2020, the hybrid tall buildings project "Four" gained construction permission from the Frankfurt city planning department. The project is a significant construction project in the city centre of Frankfurt, located in the former Deutsche Bank area (see Figure 1) in the midst of several surrounding high-rise buildings such as the Omniturm, the Japan Center, the Taunusturm and the Commerzbank Tower (see Figure 8). For a period of 45 years, the area between Grosse Gallusstrasse, Junghofstrasse and Roßmarkt was not accessible to the public. Hence, the area was popularly known as the "forbidden town" or "lost city." Since the Deutsche Bank moved its trading centre, the area has been vacant and abandoned until 2017. The project "Four" features four high-rise buildings that are all being built simultaneously by the investor Groß & Partner. One consequence of this development is monopolised land rents. Their heights will range from 100 to 228 m and have a variety of different usages, including offices, residential apartments and a hotel as well as gastronomy, sport, medical and retail facilities (see Figure 2). The ensemble of these four high-rise buildings, which are aligned in a rotating construction, was designed by the Dutch architect Ben van Berkel of the Amsterdam-based architectural firm UNStudio. It is currently in the process of being realised since October 2018 on a 16 800 m² site near the Goetheplatz in the prime midtown location of Frankfurt. A façade from the 1950s was listed as monument protection and will be preserved from the previous building fabric and integrated as a component of the hybrids.

Figure 2 portrays the hybrid tower typology of the project. The high-rise buildings will be aligned in rotation and built at different heights: Tower 1 (T1) at 228 m, Tower 2 (T2) at 173 m, Tower 3 (T3) at 120 m and Tower 4 (T4) at 100 m. The buildings, with a total gross floor area of 213 000 m² and a floor area of 16 800 m², are hybrid towers. This results in an exponential rise in the landowner's and developers' profit margins. The construction typology includes offices (48 per cent), rental apartments (20 per cent), condominiums (9 per cent), a hotel, gastronomy and retail (6 per cent) including a full-range supermarket store, day-care centre and fitness studios. The purchase prices per m² depend on the floor-number and other influencing factors such as the lines of sight to neighbouring buildings, the incident light (north or south side), the floor plan and the size of the apartment. Disturbing factors include street noise, the existence and nuisance of numerous floor neighbours, shops and workspaces, condominium co-owners, amenities, public facilities and the prestige factor. Small apartments are asking for higher square metre prices with purchase prices starting at €9000 per m² on the 6th floor and ranging up to €20 000 per m² on the top 45th to 50th floor. As an average value for



TOWER 1	TOWER 2	TOWER 3	TOWER 4	OCCUPANCY
91%	-	-	97%	Work
-	73%	-	-	Rented flats
-	-	71%	-	Condominium flats
-	21%	27%	-	Serviced Apartments Hyatt House (T2), Hotel Kimpton (T3)
9%	6%	2%	3%	Retail, gastronomy, kindergarten, fitness, spa, health centre
228 m	173 m	120 m	100 m	Height
55	48	31	25	Levels

Fig. 2: Typical hybrid tower building typologies: Development project "Four". (Source: Authors' elaborations and calculations)

a 55 m² apartment offered in tower T3, a purchase price of €825 000 or €15 000 per m² is asked by the developer. According to our findings, between March 2020 (with the outbreak of the coronavirus pandemic and the following first lockdown) and beginning of August 2020, property prices have risen by 7–10 per cent, especially in hybrid tall buildings. Moreover, smart city concepts surrounding the erection of hybrid buildings have further intensified since March 2020 (Kunzmann 2020). Indeed, smart city and smart building-concepts are offered by project developers to create additional purchase incentives particularly for buyers of condominiums.

Construction began in October 2018, with completion planned for 2023 (T2, T3, T4) and 2024 (T1). The interest rate for capitalisation and discounting results in a property interest rate of approximately 3 per cent. In the event of premature repayment, a grace period must be observed. The financial situation of the respective individual investor is not to be taken into account, i.e. irrespective of whether the company uses equity capital or full financing. The restriction in apartment size, equipment and building design worsens the ratio of gross floor area to living space by up to 4 per cent. In 2015, the purchase price for the site was €300 000 000 paid by the developer. Today, the residual value of the land – which is subject to certain uncertainties (Gat 1995; Thiel 2020) – has approximately tripled as a result of the complete vacancy and redevelopment of the plot from scratch. The construction costs will amount to approximately €1–1.2 billion as of 2019. Based on the gross floor area size, this results in average construction prices of €4700–5600 per square meter.

2 Research questions and literature review

Hybrid towers reconsidered: Vertical gated communities?

Can residential and hybrid towers ever meet the demand for affordable living space of the local, mid-income population? Which price segments can be served? Does the High-Rise Development Plan encourage land speculation and if so, how can it be avoided or curbed? Are the legal requirements of the German Condominium Act appropriate, enforceable and manageable for hundreds of residential and commercial unit owners within a single high-rise building?

In our City-Tour, we will discuss the emergence of hybrid tower buildings in Frankfurt, which adds to the growing evidence of the looming urban crisis and land policy implications caused by the property- and investment-driven evolution (also known as "property fetishism"; see Rodenstein 2000; Buchanan 2007; Blandy et al. 2010; Warner 2011; Short 2012; Blandy 2013; Easthope et al. 2014; Merkel 2016; Mach 2020). Hybrid towers generally include spaces for social and health care, retail, offices (in total 20 per cent of the gross floor area), green spaces such as a rooftop garden, indoor greenery, parks on the buildings as we as entertainment, gastronomy, hotel and residential apartments (in total 20 per cent of the gross floor area). At present, there are policies in favour of re-populating the city centres with residential properties. High-rise buildings seem to be the obvious solution due to constraints of cost and land (Kunze 2005; Albouy et al. 2018). However, this has a compounding effect on land prices in these areas, increasing the possibility of higher returns on investments. How can it be explained that luxury apartments are being built almost exclusively, with many under construction or recently completed in Frankfurt, whereas until the 1970s high-rise buildings were (and still are) associated with – to some extent – stigmatised social housing? Was the hybrid high-rise building demand even underestimated by local planners and developers?

Interestingly, there is no published large-scale comparative research on the wide span of countries' condominium laws and land policy interventions related to hybrid towers and their urban impacts in practice, except a few published papers on New York[1] (Lippert, Steckle 2016), British Columbia (Harris 2011), Toronto on condo-ism (Lehrer, Wieditz 2009; Lehrer et al. 2010) and Israel compared with Florida (Alterman 2010; Garfunkel 2017). Researchers show that residential towers have a generic built-in capacity to take on consequences similarly seen with gated communities. Tower residents are charged with significant maintenance costs which eventually lead to a breeding ground of free riders (Tan 1999; Blandy 2013; Mehaffy, Alterman 2019: 5). However, an effective decision-making mechanism is not provided by the German Condominium Ownership Act (*Wohnungseigentumsgesetz* (WEG)), neither on town-planning format nor on increased issues of security and almost Orwellian surveillance (Lippert 2019). Our research shows that the legal construction of the German Condominium Law is far from being appropriate,

enforceable and manageable for hundreds of condominiums owned by landowners within a single building.

Captured land values and vertical challenges

In Frankfurt, land with approved legally-binding building rights and construction permits has always been an asset that could be sold as a financial product. Reciprocal attempts to capture increases in land value through higher-value building rights – and above all through height deviations and exceptions from the development plan – can be traced back to the 1960s (Rodenstein 2000: 59f.). Today, the planning department of Frankfurt obligates developers to implement 30 per cent affordable and subsidised housing at restricted rent prices of €8,50 per m² on average with a duration of 30 years, based on 100 per cent of all residential floors in the hybrid buildings by legally-binding land use plans. Evidence-based evaluations of the economic drawbacks of hybrid towers as well as claimed advantages are remarkably infrequent at the global level (Ali, Al-Kodmany 2012; Ng 2017; Ahmad et al. 2017). The implications of newly introduced land policy measures are under-reported in the scientific literature, if not hardly addressed. However, there is evidence that tall residential buildings with for-sale units and large areas of amenities are significantly more destined to faster deterioration as well as greater difficulties in upgrading for energy efficiency and re-use in case of refurbishment or replacement (Thiel 2020). Furthermore, studies show evidence that the higher cost of tall residential buildings can fuel gentrification and make surrounding houses less affordable (Lehrer et al. 2010; Mach 2020). The planning department of Frankfurt is aware of the fact that hybrid tall buildings in particular are far from being paragons of sustainability. De facto, they are a highly problematic urban typology, trying to allocate the burden on those who – for reasons of property-driven self-interest – are exuberant boosters of this construction type in effort to prove that its negative impacts have been mitigated. In Frankfurt, specifications such as minimised environmental impacts should be a minimum prerequisite for any move to deregulate building height rules.

3 Rising trend of hybrid high-rise buildings: Mario Draghi and Elisha Otis as main triggers

Free movement of capital for European citizens and international companies

In 1900, the architect Cass Gilbert defined high-rise buildings as a "machine that makes the land pay." This was a strong and prescient definition, as it holds relevance even today. Due to the shortage of construction space, high land prices and population growth, cities are forced to expand vertically. The past decade has witnessed the completion of 650 skyscrapers of more than 200 meters in height worldwide (CTBUH 2018). Global cities have also experienced a steady increase in rents and housing prices. There is some empirical evidence that high-rise buildings exacerbate housing prices in growing cities (Ahlfeldt, McMillen 2018; Gat 1995). Since land is a tangible asset, its price is affected not just by its properties, but also by its units of neighbourhood. Units of neighbourhood are territorial geodetic polygons into which the forces affecting value have the greatest points of similitude or proximity. In fact these polygons are like a mould into which the market indicators are located referring to tables of analysis and concluding to unit rates of assessment to calculate the assessed value of each property. The forces affecting value are physical characteristics of the land, the legal framework, the economical circumstances, and the social profiles of the people living in that neighbourhood. The land-use of one plot alters the economic possibilities of others, creating a complex web of mutual interdependency. Frankfurt am Main is known as the financial centre of Europe and the city with the highest concentration of high-rise office buildings called "Frankfurt Skyline" or "safe deposit boxes in the sky." For several years, though, this building class has also been discovered for hotel, residential and office use as well as hybrid uses. In 2010, high-rise residential buildings serving the upper price segment were considered as hardly marketable. However, since the end of 2010, high-rise residential buildings are regarded as chic and worthwhile as local and, increasingly, global capital investments and Foreign Direct Investment.

The reason for the looming renaissance of mixed-use towers is the expansive monetary policy of the European Central Bank – "whatever it takes" (Mario Draghi 2010). This policy called for low interest rates, the politically mo-

tivated and implemented land thrift to foster inner-city development, and European basic rights derived from the Treaty on the Functioning of the European Union (TFEU) which guarantees the freedom of movement according to Art. 49 TFEU and the freedom of capital investment based on Art. 63 TFEU. The significant trigger – and severe outstanding land policy implication – for the investment in high-rises is based on Article 19 section 3 German Basic Law (*Grundgesetz;* i.e. Constitution of the Federal Republic of Germany). The personal right to property protected by Article 14 of the German Basic Law also applies for local and international corporations, limited liability companies and real estate funds, e.g., those seeking investment opportunities in tower buildings.[2] Lastly, Elisha Otis paved the way for the skyscraper boom and enabled a fascinating range of building heights after his demonstration of the safe elevator design patent in 1854.

High-rises, tall buildings and towers do not have a single definition that applies world-wide. The term "high-rises" already implies that tall buildings are the matter of subject. The exact height a high-rise building must have, in order to count as such, is not standardised. Positive and negative impacts of taller constructions increase with height and many other complex factors are at play such as materials, local building codes, zoning, view sheds, and design regulations (Tan 1999; Kayden 2000: 22–24; Craighead 2009). Tall buildings fall into four categories: single-use or mixed-use or single-tenant or multi-tenant. Remarkably, research worldwide focuses mainly on taller constructions that accommodate people who depend on subsidised housing and limited rents. Extensive papers have been written on their dysfunctions, questioning the social suitability for families and the impact on children. The case study of Frankfurt shows that office buildings, particularly in the financial district, have been confined to single-use office districts whose employees leave the area in the evening and decamp to remote residential enclaves. Presently, urban policies favour the re-population of the CBD with residential high-rises. The Building Regulation of the federal state of Hessen defines that high-rises are special constructions with a height above 22 meters. As per definition, the top edge of the unfinished floor of the highest level, that is or at least could be used as a habitable room, must be 22 meters above the average ground surface. That same definition is given by the Model Building Regulations (*Musterbauordnung* (MBO)) in § 2 para 4 no. 1 MBO and § 2 para 3 sentence 2 MBO. These are no longer subject to pure office use, but increasingly for living and in general for "hybrid" mixed use.

4 Vertical land policies and hybrid vertical spaces: Rent control and price-ceiling

In 1972, the Viennese architect Hugo Potyka proposed that property owners who were granted binding rights for high-rise buildings should compensate the public financially for the social impacts on nature as well as the human environment caused by the tower's development. Potyka drew up guidelines for high-rise buildings, the first ever written for infrastructure development which answered questions related to high-rise buildings and topography (Glauser 2018: 186). The demanded requirement by Potyka is now being rediscovered in a modified form by urban planning departments in Germany. These regulations also apply to hybrid high-rise buildings planned and constructed as "cradle-to-cradle." Particularly striking is the development in Frankfurt am Main, Dusseldorf and with a time-lag in Hamburg (project: Elbtower) and Berlin[3], based on the high-rise model of the Senate for Berlin-Mitte, e.g. at the Alexanderplatz. The vertical mixed use resembles the different aspects of an urban district with the publicly subsidised residential apartments mostly situated on the 1st to 6th floors.

Investors are reacting to these housing policy interventions. On one hand, attempts are being made to change the mix of uses while, on the other hand, publicly subsidised housing construction separated from freely financed housing construction on the same plot or in adjacent areas has been proposed. In addition to under-rent, the difference between market rent and actual rent, the reduction in value due to the rent adjustment period after the end of the rent commitment period must also be taken into account, especially since, according to current Federal Court of Justice case law, public funding and also social bindings must be limited to a maximum of 30 years.[4] As far as can be seen, the designation of milieu protection areas for high-rise buildings according to § 172 Federal Building Code has not yet been considered by the planning department. If the division of residential embedded property according to the German Condominium Ownership Act is planned for a portfolio development project, the possibility is made more difficult because of the rent-cap for 30 per cent of the apartments. According to our field sur-

vey, the default results in a restriction of ownership rights and a reduction in the value of the land of about 10–15 per cent. Uncertainties arise about the minimum rent per m² required for profitability. The building of new residential fully-served apartments has led to an explosive land value increase of 60–80 per cent in the last three years in Frankfurt, particularly in the "Europaviertel" due to the influence of recently completed, clustered high-rises.

A partition of the property that needs to be evaluated into land value and building value holds a higher importance now due to hybrid and residential tower development. To control further increasing land values, it is being discussed whether dampened land values should or must be set in place and if they are legally justified – a renaissance of the land policy debate in the 1970s not only in Germany. One can also consider vertical land policy, a

Environmental Quality	Life cycle impact assessment	UD	VC
	Local environmental impact		VC
	Sustainable resource extraction		VC
	Biodiversity	UD	VC
	Urban climate	UD	VC
	Environmental risks	UD	VC
	Safeguarding water and soil	UD	VC
	Life cycle assessment -Primary energy	UD	VC
	Water cycle	UD	VC
	Land use	UD	VC
Economic Quality	Life cycle cost	UD	VC
	Local economic impact	UD	VC
	Flexibility and adaptability	UD	VC
	Efficient land use	UD	VC
	Value stability	UD	VC
Sociocultural and Functional Quality	Thermal comfort in open spaces	UD	VC
	Thermal comfort in buildings		VC
	Indoor air quality		VC
	Acoustic comfort		VC
	Visual comfort		VC
	User control		VC
	Open space	UD	VC
	Pollution	UD	VC
	Inclusive access	UD	VC
	Urban design	UD	VC
	Robust social and functional mix	UD	VC
	Social and commercial infrastructure	UD	VC
Technical Quality	Sound insulation		VC
	Quality of the building envelope		VC
	Use and integration of building technology		VC
	Ease of recovery and recycling		VC
	Energy infrastructure	UD	VC
	Waste infrastructure	UD	VC
	Smart infrastructure	UD	VC
	Motor vehicles	UD	VC
	Pedestrians and cyclists	UD	VC
Process Quality	Integral design	UD	VC
	Documentation for sustainable management		VC
	Participation	UD	VC
	Project management	UD	VC
	Governance	UD	VC
	Construction site/construction process		VC
	Quality assurance of the construction		VC
	Systematic commissioning		VC
	Monitoring	UD	VC

Tab. 1: Urban districts (UD) and vertical cities (VC). (Source: Authors' elaborations)

different concept from the Bosco Verticale residential towers in Milan, in order to mitigate vertical gated communities, even "vertical ghettos" (Glauser 2018: 58) and urban fragmentation (Webster, Glasze 2006; Warner 2011). The tenancy ratio of accommodation in high-rise buildings can be up to about 80 per cent higher than the average ratio in the respective area. The building of more expensive housing does not help with the affordable housing shortage though. It is obvious that investors seek to gain the highest proceeds, which is why the planning department is considering introducing new rules and regulations to provide more affordable housing.

Urban district and vertical city certification for high-rises

The structural concept of a vertical city is an innovative scheme that incorporates criteria from the certification of buildings such as LEED, DGNB and urban districts or villages (Ursprung 2016: 36f.). The criteria set was developed as an indicator-based system to evaluate the sustainability of tightly packed groups of high-rise buildings. The requirement that more than two buildings form a group of defined project and unit, of which one must be a high-rise building, is to be met in order to be applicable for the urban district (UD) and the vertical city (VC) certification. The scheme of vertical cities is a kind of in-between of the scheme urban district and newly built high-rises. In regard to urban districts and urban planning, hybrid spaces or vertical hybrid spaces represent a multipurpose use of spaces.

Hybrid spaces can be found for example in urban districts as well as in single objects or building levels and sub-indicators (see Table 1). The goal is to offer a high degree of diversity in a relatively small space. In the past, urban planners have sectioned cities into several areas that primarily serve one type of use such as economical or technical quality. Some examples of such utilisations are living, working, recreation and supply. These compact cities combine a relatively high residential density with all kinds of other land uses which increase the quality of life. The ambition is to create a spatially minimised living area in which the most diverse aspects of living can be implemented. Another term for this type of area would be the urban district (UD).

Mixed-use high-rises are increasing in popularity because they are not only economical with land, but also because they are considered attractive from an urban designer's point of view. The planning principles, to support an urban densification in and around the financial district and maintain the distinct separation of the horizontal city and vertical skyline, remain the same. High-rise buildings must enhance the sociocultural and environmental sustainability of urban districts which has experienced an increase in significance, particularly in Frankfurt. Environmental consequences occur and are assessed by indicators according to Table 1. High-rises obstruct the view of the sky and limit direct sun exposure. That shadow casting is a main concern, which often restricts the building height of objects in order to maintain the liveable habitability of surrounding areas. Ground wind or "Venturi" effects, heat island and canyon effects, a concentration of pollutants at the street level, and light pollution are impacts which high-rises have on their surrounding urban districts.

5 Zoning and clustering of hybrid spaces and towers: The planning framework

The role of architects and real estate marketing specialists: The fish and the worm

In Frankfurt, the planning and construction of 22 new high-rise buildings can currently be observed. In this section, we want to examine whether the skyscraper master plan of Frankfurt encourages land speculation and if so, how can it be avoided or curbed? Can high-rises with residential use ever meet the demand for living space of the local, mid-income population, and if so, to what extent? Which compensations, such as integration of day-care centres or sports facilities, could be envisaged to balance "urban tensions?" Which standards – urban planning, architectural, design, use-specific, eco-logical – should future hybrid high-rise projects meet? Moreover, in Frankfurt, architects are confronted with one of the hardest questions regarding their self-image: For whom do "we" – the architects and planners – build and design? Conversely, could the city's population, the agora, ever define the criteria of "we"? One may find a contemporary common saying across architects: What does the fish look like that the worm must taste good to? As a result, the worm – not the fish – is ironically constructed according to this pattern which will be done by marketing departments of the developers, not necessarily by those who

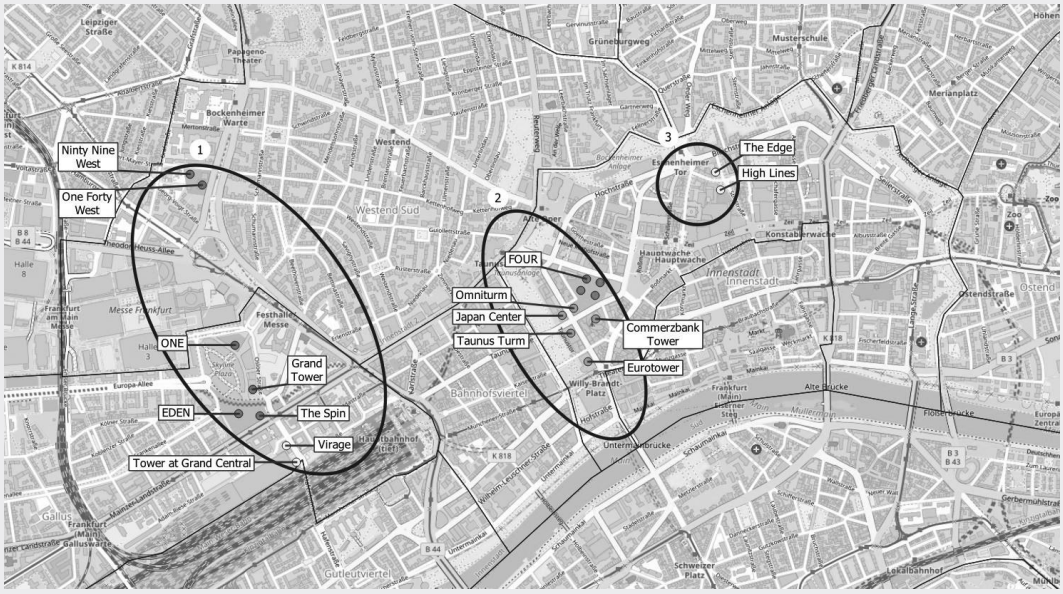


Fig. 3: Map of selected high-rise clusters in Frankfurt, as of 2020. (Source: Authors)

create and design the buildings. Architects in Frankfurt are being told that they don't need to worry about architecture and urban planning[5] because marketing specialists who work for real estate companies would do this for them. In a democracy, do we need to take into account the preferences of others whose experience of our buildings are symmetric with the public interest? If so, what are those preferences? This conundrum requires further examination. In the case of hybrid buildings, these questions take on much greater importance in the future (Hubbard 1996; Brown, Gifford 2001; Buchanan 2007; Ghomeshi et al. 2012; Ng 2017; Mehaffy, Alterman 2019: 14–16) to avoid the consequences of this malpractice that are already evident in dysfunctional cities and metropolitan areas around the globe.

Revisiting Frankfurt's Masterplan, there are three big clusters in which most high-rise development is taking place at present or will be in the foreseeable future: the fair and Europaviertel district (1), bank district (2) and the northern end of Zeil street (3). The map marks those clusters with black circles (see Figure 3). Out of these three, the cluster with the most high-rise planning and construction development is predominately the fair district. A total of six objects, such as ONE, Grand Tower (see Figures 4 and 5), The Spin, EDEN (see Figure 6), One Forty West (see Figure 7) and Ninety Nine West, are currently under construction.

Fig 4: "Grand Tower" during the construction phase, 2020. (Source: Tina Smentek)

Fig 5: "ONE" during the construction phase, 2020. (Source: Tina Smentek)

Fig. 6: High-rise project "Eden" (right building). (Source: Authors)

The bank district already accommodates many of Frankfurt's tallest buildings, including the Commerzbank Tower, Silver Tower, Eurotower, Taunus Turm and the recently completed hybrid Omniturm (see Figure 8).[6] In fact, older construction was demolished and the sites are currently revitalised by condominiums, which is seen as a common global phenomenon.

Updating and Enforcing the High-Rise Development Plan

The High-Rise Development Plan (*Hochhausentwicklungsplan* (HHEP)) or skyscraper masterplan is a framework plan in which the City of Frankfurt expresses its political opinion on future high-rise construction in accordance with § 1 para 6 No. 11 Federal Building Code. Since the legally-binding urban land-use plans must be based on the Federal Building Code, the HHEP has an internal binding effect on the administration. As far as the practical implementation – and securing through urban development contracts according to § 11 Federal Building Code – of the goals of the high-rise framework plan is concerned, it is necessary to be aware of the legal nature of the high-rise framework plan. In Frankfurt, three target areas are defined by the high-rise framework plan in connection with urban development contracts: the percentage of units designated for residential use, energy efficiency standards and the structural design such as the facade. From the city's perspective, it is important to bind the investor to the goals of the urban development contract. From the investor's point of view, it is important to know that the city will also keep to the contract, which, reversely, also includes a right for the investor to build. In the HHEP, the clustering of high-rise buildings is outlined. The informal plan prepares the development plan for high-rise buildings. An investor's violation of the high-rise development plan has no direct effect, because only the determinations of the legally-binding development plan are decisive. There is no pecuniary claim of a landowner for the inclusion of his particular plot in the HHEP.

The city uses the framework plan for high-rise buildings as a tool for incentive zoning, exclusionary zoning, form-based zoning and other design regulations. Alterman (2010: 81–88) points out that for towers, unlike regular buildings, it will not be possible to grant additional development rights in the future through incentive zoning to finance necessary updating costs and the public infrastructure. The HHEP supplements § 2 para 9 of the Hessian Building Code which regulates the construction of high-rise buildings. The example of the "Grand Tower" (see Figures 4 and 5) shows that exemptions according to § 31 para 2 Federal Building Code often modify the building law in planning practice. § 17 para 2 Land Use Ordinance (BauNVO) allows the upper limit for the extent of the building use to be exceeded for reasons of urban development, higher densification and efficient land use, but certainly not for reasons of maximising the rental income or the cash-flows of the property financiers.

How can it be ensured that the specifications in the HHEP are actually adhered to? One of the main security options is an easement *(Grunddienstbarkeit)* to enter the specifications for maximum retail space or publicly subsidised housing in the land register, which also triggers a legal obligation for a subsequent owner and/or new investor. Construction encumbrances can be used to ensure that rent control and "rent price ceilings" are effectively implemented.

Frankfurt's high-rise development began in the 1920s. Since then, the integration of high-rises into existing urban structures has been considered a great opportunity for an urbanistic scope for design. The urban building principles have changed several times from a development along axes to a cluster-development and vice versa. The first published concept in 1950 intended high-rise development in urbanistic focal points. In 1960, the so called Fingerplan (see Figure 9), which was not a formal-

Fig. 7: High-rise project "One Forty West". (Source: Authors)

Fig 8: Omniturm, 2020. (Source: Tina Smentek)

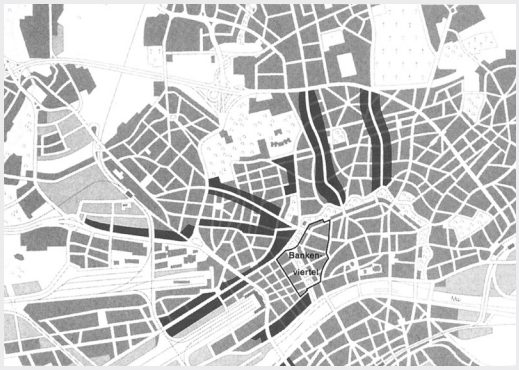


Fig. 9: The "Fingerplan". (Source: Hans Kampffmeyer, 1968)

ised legally binding land-use plan, envisaged high-rise development along axes. These axes were streets that held a certain importance in supply and transportation. The linear development led to decentralisation. The first of the two so called bank-plans proposed higher densities, contrary to the principles of the decade before. Another milestone attributive to the first bank-plan of 1970 is the accomplishment to build a high-rise that is taller than 100 metres. New technologies allowed buildings to reach heights above 200 metres, with which concerns about the effect on surrounding urban districts arose. The planning department is currently working on the second sequel of the HHEP 2000, which was already updated in the year 2008.

The 59.9 metre problem

Interpolating height averages are dispensed with, which results in a special accentuation. From a height of above 60 metres, buildings are considered high-rise buildings, according to the Frankfurt administrative high-rise directive, and are therefore of outstanding relevance to urban space. In order to circumvent the classification in the building permit or in the collateral clauses, investors have often designed buildings which, at 59.9 metres, do not fall into the high-rise tower category. The city planning office aims to prevent this development in the future to calm the city silhouette and protect certain locations from land price speculation. However, this will only succeed to a limited extent. In an update of the high-rise framework plan HHEP 2008, locations where high-rise buildings under 60 metres in height may not be built, are accordingly identified. In addition to new sites in mixed-used zones and core zones, according to §§ 6 and 7 BauNVO, previously unused sites from previous framework plans will also be subject to revision. Considerations on the use, position and height will be made. By considering each site individually, the HHEP 2008 intends to prevent land speculation. However, project developers have decided against the selection of individual building plots, as otherwise the value of these defined building plots and thus the standard land value would increase enormously. The examination of several sub-topics aims to give a profound calculation on development possibilities, which then lead to precise and practical recommended action principles. The selection of plots has saved the market from real estate speculation, which has previously been a problem the city had to deal with. However, the allocation also leads to an enormous increase in the land value of these land plots, which project developers, planners and investors criticise strongly.

The myth of "increased density" by tower development

One of the main advantages of high-rise buildings is the dense settlement pattern. Urban density reduces sprawl and thus the sealing of natural land. This approach isn't false per se, but there are some factors that must be taken into account (Mach 2020). From an urban sustainability perspective, it is not only density, but the efficient placement of people and their activities, that is important. The "optimum density" has not yet been found in the interplay of community facilities, shops and workspace, maisonettes, houses and apartments within the high-rise area. The plot of land that is proposed for a high-rise development must first be assessed in detail. Low- and mid-rise developments must be considered as they do not necessarily have lesser densities than high-rises and sometimes might be a better fit for the plot of land. Whether the object is intended to accommodate mostly young families with children, students, the working generation or elderly people, also has a significant impact on which type of building will be chosen. However, it has never been the explicit goal of urban planning in Frankfurt to increase population density and to ensure a levelling of the social fabric through high-rise construction.

6 Valuation of hybrid towers: Spill-over effects and price range

It is surprising that there is such a great demand for apartments in Frankfurt. Ten years ago, it would have been inconceivable for a wealthy citizen from the Taunus region wanting to live in a 250- or 300-family house with

average purchase prices of €8500 per m² of living space.

Studies have revealed that construction costs increase exponentially with the height of the building. Evidence from the carried-out fieldwork shows that in particular hybrid towers entail higher rather than reduced maintenance costs per unit; therefore the taller the building, the more complex (however, not linear) and exponentially increased profit for the developer. High-rise development in Frankfurt leads to prices of €9400 per m² in CBD regions, with condominium high-rise buildings having the following price range: €7540 per m² (ground floor to 10th floor), €8500 per m² (11th–20th floor), €9300 per m² (21th floor–30th floor), €11 660 per m² (31th to 40th floor) and €19 530–22 500 per m² above the 41th floor. Research presents a 7 per cent value increase as an outcome of sustainability certification (City of Frankfurt/ Valuation Committee, 2020; see Figure 10). At the current stage of the high-rise boom, it remains unclear which year's purchase and real property interest rate is in line with the market. Certified districts indicate a rise in land value, as a square meter of gross building land can be sold with an average increase of + €3,50 per m². Profits are not restricted to sales proceeds figures. Rents for objects within certified districts are expected to be 12 per cent higher on average.

Neoclassical theory suggests that the land use of one plot alters the economic possibilities of others, creating a complex web of mutual interdependency (Zahirovich-Herbert, Gibler 2014). The capitalisation of land is reality and has a decisive influence on what happens to the surrounding land market. Criteria for capital investment include the level of interest, the security of the capital invested, the preferences and the risk tolerance of the investor. Expected income from a high-rise property is primarily based on the existence of ground rent. The Frankfurt city planning department seeks to influence (more precisely, minimise and cap) the ground rent by land policy measures; however, the results have been meagre up until now. The growth of urban land rent, as a result of increased value due to industrialisation and urbanisation, is being attributed to the net income from land use – i.e. a high-rise zoning for building purposes. But owners and buyers (also sellers) often have no or insufficient up-to-date knowledge of the local land market in which they act and depend on.

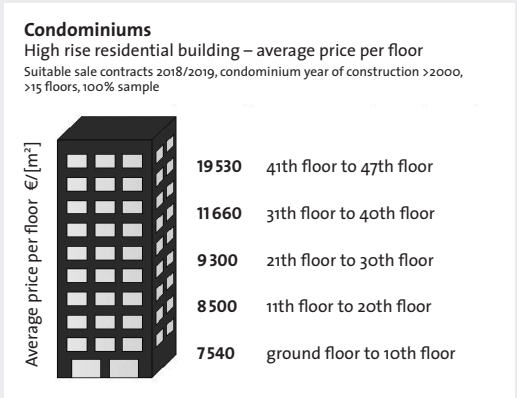


Fig. 10: Price range in a typical residential high-rise, price index of 2020.
(Source: Authors' elaborations and calculations)

Our research clearly shows that the proportion of newly constructed high-rise residential buildings in Frankfurt has a strong influence on the average prices in its individual locations. The neighbourhood effect alters the land rent and building market prices (Gat 1995; Zahirovich-Herbert, Gibler 2014). This is all the more astonishing as the market share of these buildings compared to the total number of new buildings is only about 11 per cent, but the spill-over effect on the surrounding standard land values is considerable. One factor influencing the land value is of course the height of the building. The lower floors show a linear increase with the land value increasing in parallel with building height. The floor height also influences the standard floor value. If the floor height is significantly higher than the standard, stipulated in the Hessian building regulations, the land value increases. From the 5th floor upwards, the increase in land value is reduced gradually due to higher construction costs. In summary, the construction costs "absorb" the increase in land value.

Land values of high-rise buildings: "as though vacant"?

A common question, that is yet to be fully answered, is whether the standard value of land that surrounds high-rise buildings is increased by the construction of such. An assessment of the development of standard land values over a period of time has shown that, in most cities, high-rise buildings indeed increase the standard land value of surrounding urban districts and therefore impact their sustainability. The first finding is that an increase in standard land value takes place in many cities regardless of a high-rise development. It needs to be addressed that the standard land value development in Frankfurt am Main is unique, like the respective developments in other cities as well. A false approach would be to take the standard land value development of another German city that features less high-rises, for example Stuttgart, and compare that development to the one in Frank-

furt and assume that the calculated difference in those two developments equals the impact of high-rise buildings on the standard land value. Especially § 196 para 1 sentence 2 Federal Building Code must be interpreted and subsumed critically. The wording "to be assessed as if the land was undeveloped" does not properly define the status of "undeveloped" land.

Whether and how existing, measurable impacts such as shadow casting, ground wind effects, heat island effects and higher pollution affect the standard land value is not legally determined. An improvement to this approach is to calculate a weighted average of all applicable standard land values by using regression analyses. Frankfurt might be experiencing an abnormal, unexpected process that results in it being incomparable to other cities. The plan has an influence on land values even before it is published. If the HHEP allocates a certain location for a high-rise project, the quality of the designated land changes. But this also applies, in the broadest sense, to the quality of the land surrounding that location. Due to the understatement of those terms, no profound presumptions can be made regarding the influence of high-rise buildings on the standard land value of surrounding objects. The Standard Land Valuation Guideline (*Bodenrichtwertrichtlinie* (BRW-RL)) provides a more practical definition in regards to standard land values. Chapter 6 para 1 BRW-RL defines that the land characteristics of one single property shall conform with the majority of the land characteristics that lay in the same standard land value zone *(Bodenrichtwertzone)*. The expression "shall" indicates a sort of unconstraint and therefore makes room for certain divergence in land characteristics. Furthermore, chapter 6 para 4 BRW-RL clarifies that the standard land value of single properties does not include characteristics that can only be identified in the assessments of single objects. One example of the impact high-rise constructions have on surrounding objects is shading, which refers to the shadow casting by a high-rise building affecting many of its surrounding objects, to different extents. Whether this circumstance counts as a characteristic applying to the majority of the properties or is rather seen as a characteristic that can only be assessed in case-by-case observations, is not legally specified. There is a lack of regulation as to when a characteristic applies to the majority or just to a smaller minority of the standard land value zone. No applicable proportionality, ration or reference figures are stated in the valuation guidelines.

7 Summary: Potential for conflict

The hybrid tower project "Four" and further 22 comparable constructions in Frankfurt are at the early stage of their completion. Given the potential of long-term impact on the economic, social, natural and human environment, the situation in Frankfurt seems to warrant immediate remedy. Our research has found significant negative impact in the category of planning, vertical land policy, and land valuation with some of these aspects under-reported in the scientific literature. Are hybrid towers "fashionable", or "edgy", or – at the opposite – "reactionary" or "inauthentic" (Mehaffy, Alterman 2019: 15)? The strategy of the Frankfurt planning department to combine the issue of a building permit with legal exceptions for higher-quality building law explicitly in conjunction with affordable housing construction is risky since it violates the fair and equitable treatment of investors following the Treaty of the Functioning of the European Union in case of disproportionality. In addition, the social housing construction does not determine how expensive a flat may be rented, but only which materials must be used and how the layout must look like. This is often overlooked or ignored in the public debate therefore in Frankfurt, the weightiness of public interests to justify the approval of hybrid buildings is reduced. The major recommendation to policymakers given by Alterman (2010: 89) describing that tower projects should be aimed only at upper-income households is less supported and followed by the planning department of the Frankfurt municipality.

Although high-rises may appear to be an improvement to a region at the time of planning, construction and initial utilisation, adjustments or replacements will unavoidably have to be made. It is clear that any negative impact on economic, social and environmental qualities will inevitably lead to a decrease in the sustainability of the affected urban vertical districts (see Table 1). The greater difficulties and economic challenges that come with upgrading high-rise buildings to newly expected standards and continuous urban development are barely addressed at all. Furthermore, high-rise buildings, which advertise with upmarket amenities and unique, often unobstructed views onto the surrounding area and into the distance, have significantly higher maintenance costs which are often not clearly communicated by the developers and their marketing agents. Contrary to conventional wisdom, our research has shown that hybrid buildings show a reduced life

span, increased operating expenses and may result in obsolescence after 30 or 40 years, especially for high-rises with a condominium-type ownership. Towers are thus destined to faster deterioration, while the costs of operation rise exponentially due to advanced durability.

The legal character of privately owned, but semi-public amenities within hybrid towers such as sports facilities, rooftop swimming-pools, gardens or bars is still disputed. For example, access to these amenities could be blocked to the public either by regulation or by selection criteria such as entrance fees. There is no particular evidence on this subject for hybrid towers, where the potential for conflict between individual owners and the collective entity, to which individual owners belong, as well as the potential for conflict between different groups of owners in the towers – private owners, funds, hotel branches, corporates etc. – will emerge very strongly. There are numerous worldwide examples of the incoherency as well as incompatibility of private condominium law and commercial law with multi-owned and multi-titled housing (Blandy et al. 2010: 225–234; Easthope et al. 2014; Lippert 2019). Above all, amenities are not supported by the German Condominium Ownership Act (WEG) and by the Real Estate Valuation Ordinance. The future will show to what extent additional services such as larger condominium owners' meetings and areas could be operated and administered. The implementation, planning and thus financing of the extensive fire-protection regulations can be integrated into the community regulations of the multi-owned hybrid association. It is not possible to dispense with a manager. Under the legal regime of the Condominium Ownership Act, buying an apartment means that the owner owns the air between the walls and a percentage of the land according to the m²-size of the condo shared as co-ownership. The legal framework of WEG is fundamentally not prepared for the requirements of a community of 250 to 300 commercial and residential owners in one single property or for the maintenance and financing (levy) of vertical public spaces. However, the "Condoization" (Lippert 2019) is on the rising trend in all emerging metropolitan areas of Germany.

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Notes

1 Michael Wilson: A ghost town at the heart of New York. The New York Times International Edition, 27th July 2020, p. 7.

2 German Constitutional Court, Decision of 6th December 2016, BVerfGE 143, pp. 246, 313, footnote 187 – *Atomausstieg*.

3 "Kreuzberger Mischung, vertikal gestapelt". Immobilien Zeitung, 16th May 2019, No. 20/2019, p. 28, on the integration of affordable housing in a residential high-rise in Berlin-Kreuzberg.

4 German Federal Court of Justice, Decision of 8th February 2019, Neue Juristische Wochenschrift (NJW) 2019, p. 2016 – No unlimited, but long-term commitment (max. 25–30 years) of public social housing and capped housing rents.

5 Andreas Moser, cma cyrus moser Architects, presentation at the symposium "High-rise development plan for Frankfurt – general conditions and effects of a new update", 11th July 2016, Frankfurt.

6 Birgit Ochs: Türmchen, öffne dich! Arbeiten, Wohnen, Freizeit – die nächste Hochhausgeneration ist vielseitig. Macht sie das zu besseren Nachbarn? Frankfurter Allgemeine Sonntagszeitung, 11th November 2018, No. 45, p. 51.

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