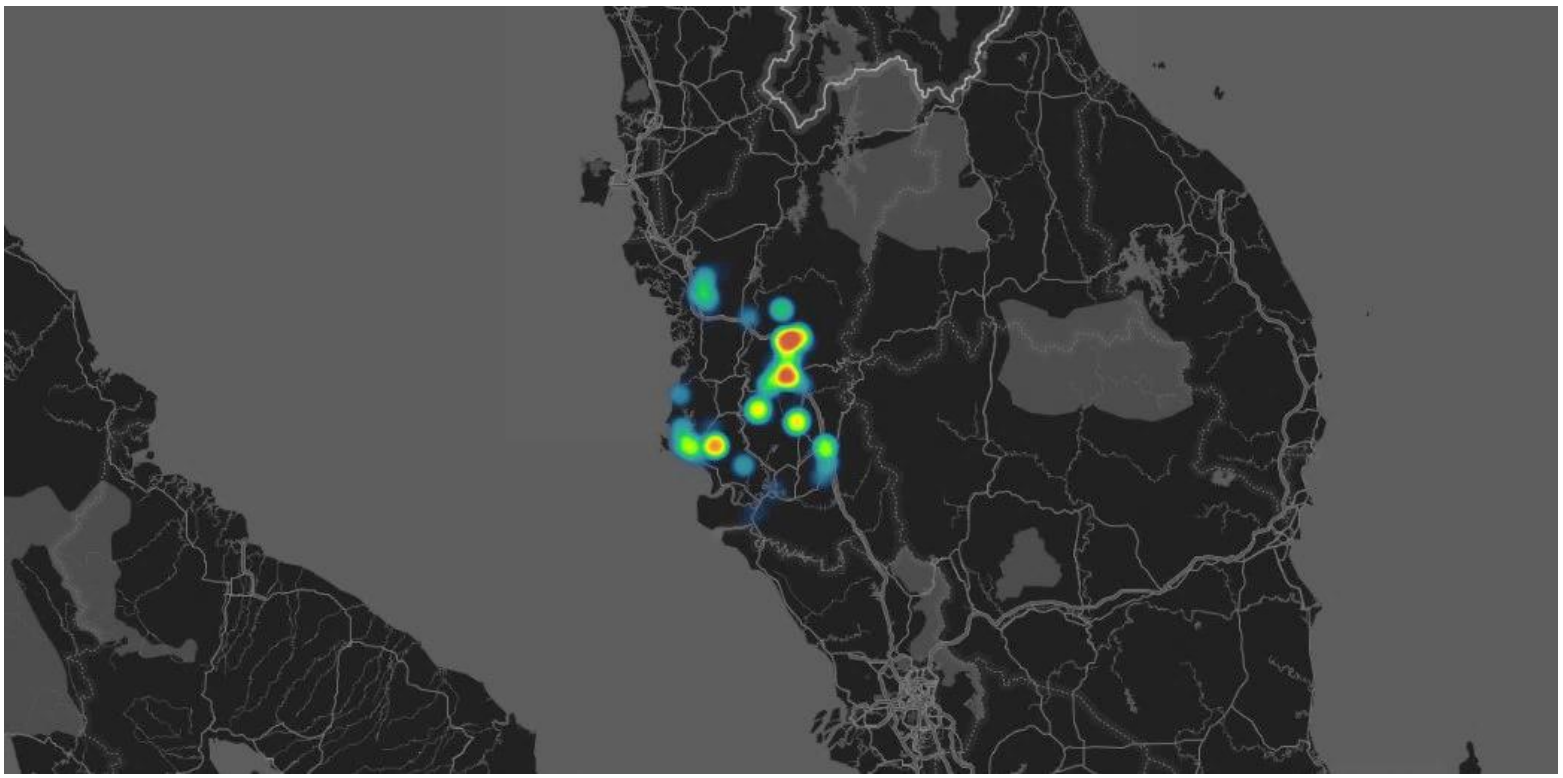
Impacts of land and real estate development on regional urban structures.

The case of the ‘Perak Diamond’ in Peninsular Malaysia.



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Foreword

This thesis is part of the joint research project on regional urban dynamics of the so-called 'Perak Diamond', a conceptual urban configuration in the state of Perak in Peninsular Malaysia. This research project is a collaboration between Utrecht University and ThinkCity Sdn Bhd, under supervision of Dr. Leo van Grunsven and Matt Benson, programme director at ThinkCity.

The research team consists of six students from the master programme Human Geography, each focussing on a different topic: infrastructure, investment patterns, economic dynamics, urban functions, commuting patterns and land- and real estate development. This thesis focusses on the latter.

The project offered a unique chance to combine personal interests in real estate development and the built environment in my master thesis, while discovering the beauty of Malaysia's nature and its people. I look back on an interesting and challenging period where I developed both my research- as professional skills.

I would like to thank Leo for his time and critical notes.

Leiden, 2019

The illustration on the frontpage visualizes the spatial distribution of APDL's in the period 2013-2017, which is used as indicator to show concentrations of construction activity in the study area. *Source: authors calculations, based on data from LPHP. Base-layer for visualisation: Bing Maps (2019).*

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List of abbreviations

APDL	Advertising Permit and Developer's License
B40	Bottom 40% household income group (monthly income below RM3000)
DEVEX	Development Expenditure
DPNP	Perak State Housing Policy
FELCRA	Federal Land Consolidation and Rehabilitation Authority
FELDA	Federal Land Development Authority
GHSL	Global Human Settlement Layer
GLC	Government Linked Company (a subsidiary of the State Government)
JPBD	Jabatan Perancangan Bandar dan Desa Federal (Town and Country Planning Department)
JPPH	Valuation and Property Services Department
KRI	Khazanah Research Institute
LPHP	Lembaga Perumahan & Hartanah Perak (Perak Housing and Real Property Board)
NAPIC	National Property Information Centre
NPP	National Physical Plan
PPA1M	Perumahan Penjawat Awan 1Malaysia (affordable housing scheme)
PPP	Public-Private Partnerships
PR1MA	Perumahan Rakyat 1 Malaysia (affordable housing scheme)
PTG Perak	Pejabat Tanah dan Galian Perak (Land and Mines Office Perak)
PUR	Polycentric Urban Region
REHDA	Real Estate and Housing Developers' Association, Malaysia
REIT's	Real Estate Investment Trusts
RM	Malaysian Ringgit (local money currency)

1.Introduction

As Peninsular Malaysia further urbanizes, economic advancement increasingly pivots on the performance of its cities. This depends on a range of characteristics spheres of urban economy, society, business environment, governance and spatial structures. Leveraging agglomeration economies and positive externalities of proximity, mass and density, spatial structure is a challenge in accomplishing an efficient urban system in Peninsular Malaysia.

1.1 Peninsular Malaysia's urban system configuration

It has been increasingly recognized that Peninsular Malaysia's urban system and its main cities face several challenges in respect of spatial structure. These have been defined and analysed in several reports and policy documents, including World bank (2015), National Urbanization Policy (NUP1 and NUP2, 2016-2026), as well as the third National Physical Plan (2015-2020), addressing the urban performance issues at city and conurbation level, whereby, in line with the mainstream approach, the urban system is conceived as hierarchical. However, it is increasingly argued that there are shortcomings to the hierarchical approach at regional and sub-regional level. Indeed, concerning spatial structure, insights are advancing of the relevance to performance of dimensions beyond city size. At the regional and sub-regional scale these refer to urban configuration reflecting internal spatial structure, and, respectively, to functioning and inter-settlement structure. At both levels, density and mass related characteristics are associated with economies and productivity. Specifically, at the lower level these include land-use and integration, as well as connectivity, emphasizing the role of morphological and functional features against a hierarchical inter-settlement structure mostly holding back productivity.

One of the ways the mid-level cities could assume a larger role and develop mass is by enhancing regional urban structures. Related to centricity of a regional urban structure, one option is a monocentric configuration. Alternatively, the idea of networking and polycentric development has been advanced. This is translated into the view of assemblages of *proximate urban centres* displaying high connectivity, constituting polycentric urban regions, thus 'producing' agglomeration economies through 'combined' or 'borrowed' size.

1.2 Polycentric development policies

The concept of polycentricity has been given lots of attention by policymakers, who widely adopted the idea in development and planning strategies. As a matter of fact, the European Spatial Development Strategy (EC, 1999) placed polycentricity at the heart of current spatial planning policies across Europe (Green, 2007). According to such policies, polycentric development in a region can be used as a strategic instrument to achieve multiple goals towards more efficient, balanced and sustainable patterns of spatial development, enhancing performance and productivity (Burgalassi, 2010; Commission of the European Union, 1999). The basic idea of a polycentric configuration is that the combined mass of multiple urban centres in a region, provided that these are well connected, is larger than the sum of the individual centres, which allows for agglomeration advantages. A polycentric structure is the opposite of a monocentric configuration, whereby one urban centre plays a key role in the regional urban system (Burgalassi, 2010; Meijers, 2008).

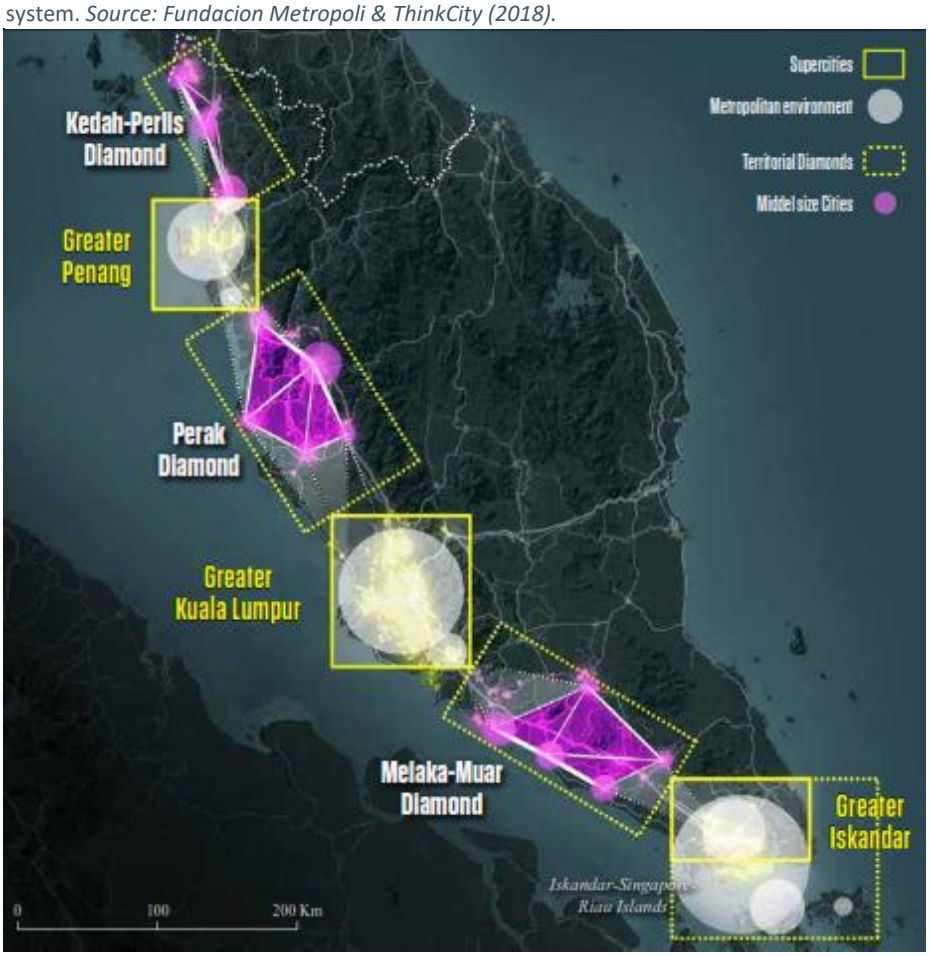
It is argued that gains form polycentric development can especially be obtained if urban centres develop in a compact manner, enhancing efficiency. However, several studies have shown the existence of urban sprawl phenomena in Malaysia, characterized by low-density developments in greenfield areas (Osman, Abdullah & Nawawi, 2017). Such trends impact the compactness of urban form and negatively affect urban mass, undermining conditions that enhance efficient polycentric development.

The necessity of steering the development of the Malaysian urban system and its cities in a different direction is argued on several grounds. In fact, rather than privileging higher order centres from efficiency considerations and focusing on independent growth of individual centres, the focal point should shift towards spatial structure elements of urban structure and spatial configuration. It is held that urban economic performance would benefit from defragmentation and a polycentric structure.

1.3 The concept of 'Perak Diamond'

The divergence between hierarchical approaches and studies on polycentric urban configurations underlines the need of a complementary research to the 'Malacca Straits Diagonal'. This is a vision which entails the potential for the western coast of Peninsular Malaysia to be shaped by a succession of urban conurbations and so-called "Diamonds" (figure 1), which are structures encompassing networks of cities forming morphological and functional polycentric urban configurations (Fundacion Metropoli & ThinkCity, 2018).

Figure 1*:* The concept of the 'Malacca Straits Diagonal', an urbanized coastline that consists of multiple polycentric configurations, so-called Diamonds, filling the voids in the settlement system. *Source: Fundacion Metropoli & ThinkCity (2018).*



In particular, the concept of "Perak Diamond" is put forward as a potential polycentric configuration located in the area between the two main urban nodes of Greater Penang and Greater Kuala Lumpur (figure 1). The 'Perak Diamond' would span most of the coast of the state of Perak. This potential urban configuration is shaped by the functional area that is formed by the isochrone of 1-hour travel from Ipoh, the largest city in Perak, and the isochrones of 30 minutes from the smaller cities of Lumut, Teluk Intan, Taiping, and Tapah (figure 2). In terms of the Diamond's urban system, it is argued to be predominantly led by Ipoh and, according to this vision, it would potentially represent a strategic node articulating the connection between Penang and Kuala Lumpur, filling a void in the settlement system of the Malacca Straits Diagonal.

Figure 2: The administrative districts (light blue) and cities (yellow) that are identified as the centres which can possibly support a diamond structure in Perak. *Source: Fundacion Metropoli & ThinkCity (2018).*

1.4 Main theme of the joint-research and individual focus

In practical terms, the approach of the joint-research targets regional urban system development in Perak, aiming at unravelling the configuration and functioning of regional urban settlements systems, including *current presence of polycentrism*, as evidenced by inter alia functional areas of centres, interaction patterns, distribution of investments and economic function, overall mass and performances. Consequently, the potential to develop or augment mass through urban polycentrism at regional level is investigated. Considering the need for in-depth analysis to appraise development and performance of regional and sub-regional urban systems, as well as the focus on the potential of polycentric spatial structure at regional level, the research approach opts for a case study (van Grunsven, 2019).

In the joint-research, the urban system of the Perak 'Diamond', as demarcated in the ThinkCity 'Reconceptualizing Malaysia's Urban Future' draft report (2018), is scrutinized in detail to unravel the characteristics of the physical and socio-economic environment, physical connectivity, and intra- and inter-centre interactions of individual urban centres in the Perak urban system.

From this starting point, the approach of the joint-research is to inspect the eventual presence of polycentricism in the functioning of the regional urban system, assessing its relevance from the perspective of performance related to urban structure and inter settlement configuration. It follows an investigation of the potential for the urban region constituted by the Perak Diamond to develop or enhance polycentrism with a view to building more agglomeration economies, density and mass, deriving into feasible performance gains (van Grunsven, 2019). Providing the basis for and criteria in the definition of polycentricism, several *dimensions* are addressed in the joint-research:

- *Morphological*: equal size urban centres located in proximity
- *Functional*: economic specialization and complementarity; borrowing size and economic 'scale'
- *Relational*: multi-directional connectivity and flows, with a minimum and maximum time taken to cross distance
- *Institutional*: coordination-driven integration

Within the context of the joint-research, this thesis focusses on the **morphological dimensions** of polycentricity, and specifically on the characteristics of the physical development of Perak's urban system.

1.5 Aims of this study and research questions

The aims of this study twofold, namely to (i) *to establish the centrality of the regional urban system of Perak in the morphological dimensions, based on spatial patterns of building construction*, and (ii) *to identify the drivers and actors that influence land- and real estate development processes*. More concrete, this involves spatial analyses of the physical evolvement of urban settlements in Perak over time, based on patterns and concentrations of building construction. This information indicates how Perak's urban system evolves, and whether this pattern corresponds with characteristics of polycentric growth. Based on this, other scenario's, such as monocentric growth, can be excluded. Besides this, the study aims to explain the (local) context in which urban planners, land managers and real estate developers operate. The findings of this research will provide crucial information that is necessary to understand the potential of shaping a polycentric urban configuration in Perak. Based on the above, the following research question has been formulated.

Where in the 'Perak Diamond' does land development, designated for building construction, takes place; what are the drivers behind these developments; and what are the implications of these developments on the morphological urban structures in the region?

This central research questions will be answered based on five sub-questions:

- *What growth patterns of the built-up areas and population can be identified in the study area from 1990 onwards? Based on this; which areas in the study area can be defined as urban centres?*
- *On which location in the study area are current building construction projects located, what are the features of these developments and who are the rightful land-owners of these building sites?*

- *Which actors are involved in land development processes in the Perak region and what is there role in these processes (controlling, developing, financing, regulating)?*
- *What are the motives of (local) real estate developers when it comes to site selection decisions for building projects?*
- *To what extent are land development processes in Perak steered by urban planning?*

To answer these questions, a multidisciplinary approach is used, which takes advantages of both quantitative and qualitative methods (as explained in more detail in the methodology section). Real estate developers and governmental agencies are hereby identified as the central actors shaping the urban structures. These questions, once investigated, will provide a complete overview of the physical composition of the built environment in the region, its historical evolution and the context in which land- and real estate development takes place. These findings allow verifying whether *the morphological configuration of the 'Perak Diamond' can indeed be described as a polycentric system or, alternatively, as a monocentric of archipelago structure*.

1.6 Scientific relevance

As stated by Florczyk et al. (2019), there is a gap in the global monitoring of the urbanization process in all its dimensions. Most internationally recognized methods of measuring polycentric structures are focussed on metropolitan regions in North America and Europe. While emerging countries could also benefit from polycentric development, very few in-depth empirical studies have been carried out in cities or regions in such countries (Xie, Hou & Herold, 2018). Most often, this has to do with the lack of relevant data for such analyses. Therefore, this research makes an attempt to contribute to the existing methods for polycentric measurements, by combining alternative data sources that are available in most developing countries. The combination of such data sources offers a comprehensive overview of the development of regional urban structures. The originality of this research lays in the fact it also takes into account *current* real estate development patterns, which are used as indicator to identify how the centricity of the regional urban structure evolves.

Besides this, the *processes* through which regional urban structures are formed have been given little attention in the social scientific literature on urbanisation and urban development, as most literature focusses only on the impact of built-up area expansions, without considering the context in which these expansions take place. "The role of land ownership, the organisation of the construction industry, the nature of the finance invested in urban development and the significance of intermediaries, from developers to property consultants, lie hidden or are given little more than a passing reference in many historical accounts of urban development, with notable exceptions in the urban history research" (Healey & Barrett, 1990, p. 89). Although more and more literature elaborated on land and real estate development processes by itself, little attention has been given to the direct impact of such processes on regional urban structures.

In the context of Malaysia, most literature on urban development focusses on the large metropolitan areas such as Kuala Lumpur and Greater Penang. It is widely argued that more studies should focus on the less developed urban regions, by addressing the phenomena that shape and impact the environment. This research contributes to this knowledge. The societal relevance also stems from this.

1.7 Outline of the thesis

After introducing the context of the research (chapter 2), where the characteristics of the study area are described, the investigation proceeds with the Theoretical Framework (chapter 3), in which relevant theories and concepts are discussed. The Methodology section (chapter 4) offers an overview of the methods and data sources that are used in this research. It also explains some limitations of the data.

The next two chapters present the spatial analyses for population distribution and built-up area expansion. Insights in population distributions and urban growth patterns in the study area are first discussed (chapter 5). After that, historical analyses of built-up area expansions have been visualized for some of the urban areas (chapter 6), which allows for detecting urban sprawl phenomena or the opposite, namely compact development. Insights of these chapters are combined to calculate population densities for different urban areas, which is an indication of the current presence of urban mass in the study area. The findings help to identify whether *historical* urban growth patterns showed characteristics of polycentric development.

The following chapter discusses recent patterns of building construction (chapter 7) on a regional scale level. This provides insights in where recent construction activity is located, and whether this indicates an evenly distributed pattern or rather high concentrations in certain areas. These findings help to identify whether *current* urban growth patterns show characteristics of polycentric development.

The next chapter zooms in to local development trends (chapter 8) and discusses some notable observations and typical development patterns. The findings help to explain differences in the *efficiency of built-up form* in different urban areas.

The final chapter describes the development context and influential (f)actors (chapter 9). It aims to identify the *drivers* behind the observed patterns in the former chapters, such as the differentiation in land costs, the impact of affordable housing policies and spatial differentiation in household income. This chapter also pays attention to the (legal) procedures to transform land use, and how this results in inefficient zoning plans.

The conclusion (chapter 10) uses the overall research findings to verify whether the morphological configuration of the 'Perak Diamond' can indeed be described as a polycentric structure or, alternatively, as a monocentric of archipelago structure.

2.The case study area

This section presents an overview of the State of Perak and the geographical unit of analysis in this research. As anticipated, the objective is to shed light on the urban configuration of the region from a morphological perspective, verifying whether a polycentric structure can indeed be identified. As the boundaries of the so-called 'Perak Diamond' are not definite and require further analysis, this section describes the identified study area in the Perak region, which is consequently investigated through quantitative and qualitative methods.

2.1 Location and administrative districts

The state of Perak is located in Peninsular Malaysia. It is one of the thirteen States of Malaysia, and the second-largest one with an area of over 2,000,000 hectares (DOSM, 2019). It borders the Kedah at the North, Penang to the Northwest, the straits of Malacca to the West, Selangor to the South, Kelantan and Pahang to the East and Thailand to the Northeast (figure 3). It has a population of about 2,6 million[2], which is expected to rise to 3,7 million in 2040 (JPBD, 2016).

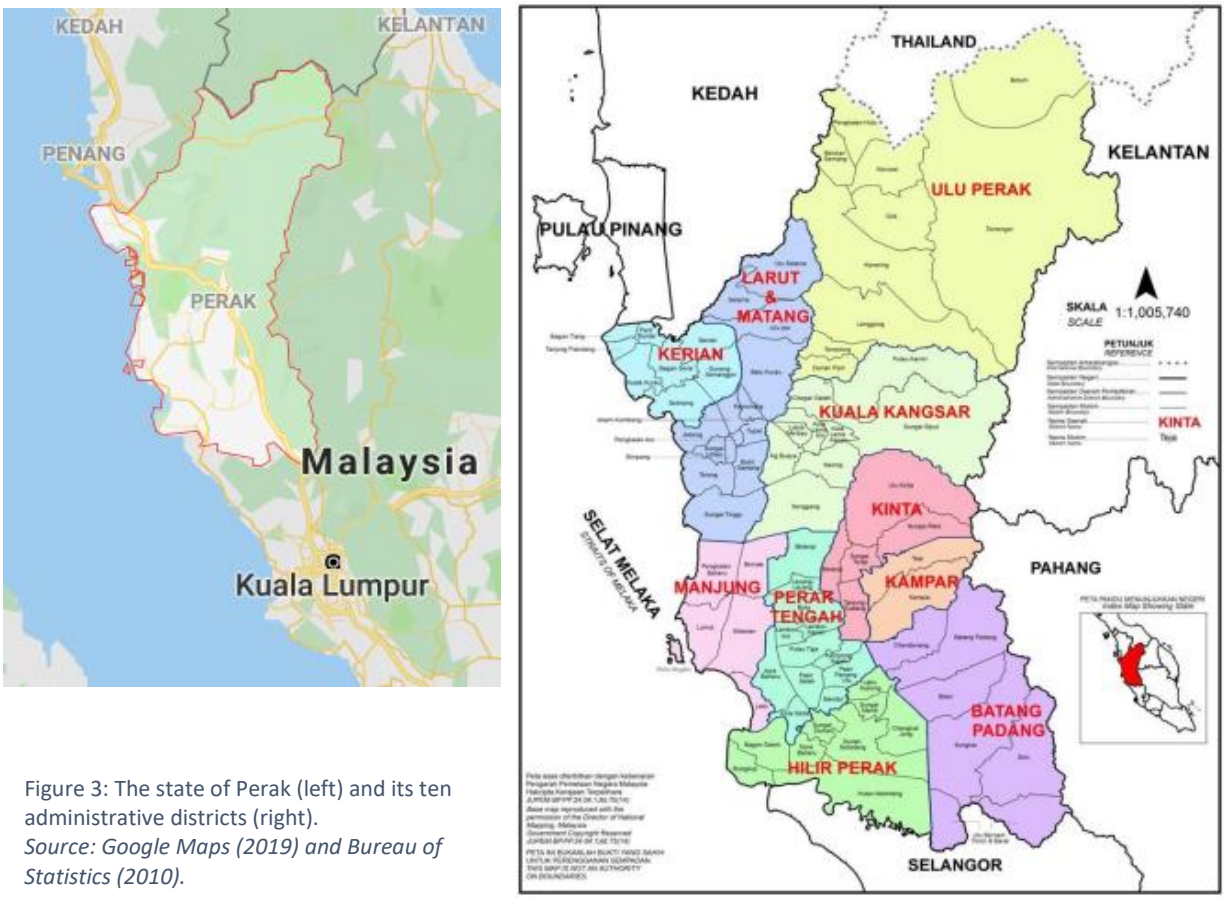


Figure 3: The state of Perak (left) and its ten administrative districts (right).
Source: Google Maps (2019) and Bureau of Statistics (2010).

Perak is divided into ten administrative districts[3] (figure 3) which are further divided into mukims (sub-districts) and municipal councils. The State's administrative capital is Ipoh, located in the Kinta district. The royal capital remains Kuala Kangsar, where the palace of the Sultan of Perak is located.

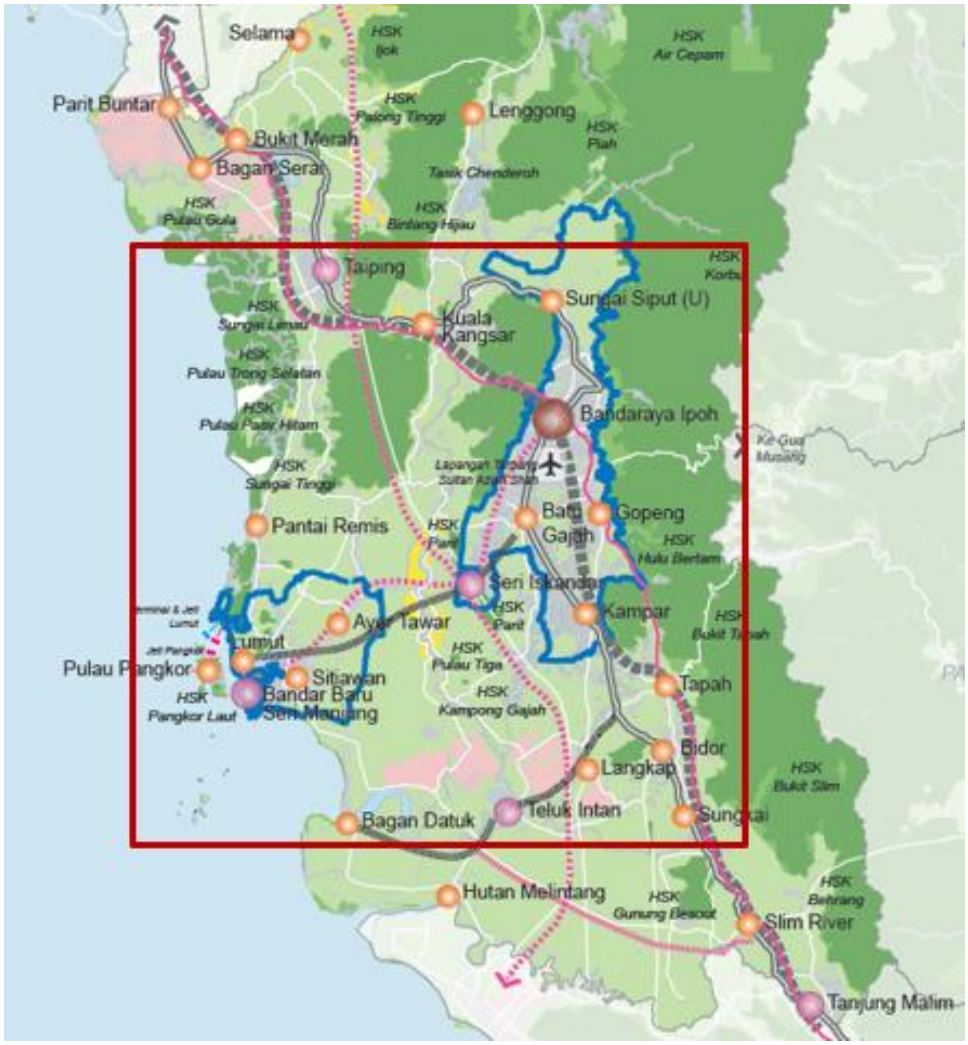
[2] 2020 estimations. *Source: DRSNP (2018).*

[3] Since 2016, the two southern districts, Hilir Perak and Batang Padang, split into two new districts: Mualim and Bagan Datuk. These districts have been excluded for most analyses, as documentation about these districts is unclear in governmental documentation. Besides this, data for these districts is not yet available

The Kinta district is the most populated district, with a population over 800,000, followed by the districts Manjung and Larut & Matang. The district Hulu Perak, located in the north, exists of mainly rural areas and falls outside the investigated study area.

The 'Perak Diamond' has no official boundaries as it is a conceptual area. In the research, this area has been defined as the central area of Perak (figure 4). This area exists of multiple cities, of which thirteen cities are central in this research. The largest is Ipoh, followed by Lumut-Sitiawan, Taiping and Teluk Intan. The other cities are Kuala Kangsar, Sungai Siput, Batu Gajah, Gopeng, Pantai Remis, Seri Iskandar, Kampar, Tapah and Bidor. The landscape in between these cities is mainly characterized by forestry, palm oil plantations and other forms of agriculture (see Appendix 2.2).

Figure 4: The research area within Perak (indicated in red). The blue lines indicate so called promotion zones. *Source: DRSNP (2018.)*



2.2 The tin-mining industry as a major driver of urbanization in Perak

During British colonial rule (1786-1957), Peninsular Malaysia was divided into three administrative divisions: the Strait Settlements, the Federated Malay States and the Unfederated Malay States (Harun & Jalil, 2012). Perak was one of the four Federated Malay States, which were all rich with the natural resources of tin and iron ore. As a result, mining activities became a primary economic specialisation in this region. In Perak, these mining activities led indirectly to the formation of 'tin town', such as Ipoh,

Taiping and Batu Gajah in Perak (Harun & Jalil, 2012). Especially towns located alongside rivers were of interest, which offered strategical benefits for transport routes and water supply, which increased trading activities. Such towns are known as 'Bandar Kaula', which means estuaries town, as they are located at river estuaries (Harun & Jalil, 2012). Kuala Kangsar, the royal town, is an example of this. To stimulate more efficient trading between these towns, mainly in tin and rubber, new infrastructure developments, mainly road construction, started to shape the physical development of the region.

2.1.1 Influence of the colonialists on urban planning practices

The Dutch, Portuguese, and British implemented their town planning practices into Malaysia's system. Some buildings nowadays still present the colonial style, characterized by typical western architecture, especially for governmental buildings in the main centres. The footprints of western colonialism can be found back in the built-up patterns of cities. Especially the British impacted the urban planning systems, by introducing 'grid systems' in physical urban planning. This grid-system shaped the physical structures of major cities in Perak, such as Ipoh, Teluk Intan and Taiping (Mamat & Aziz, 2018), which is now still clearly visible. So, the geographical locations and natural resources of certain 'early Malay towns' contributed to the involvement of colonialists on urbanisation processes and the physical development of these places.

2.3 Main economic activities and cities profiles

Favoured by a strategic location and plentiful natural resources, Perak has historically been benefitting from the tin-ore trading. This advantage was translated, in Perak's earlier history, in an economic and cultural flourishing. Nevertheless, because of the gradual depletion of natural resources and the drop in the price of tin-ore, the once most populous State of Malaysia saw an economic downturn and a massive manpower drain to higher-growth neighbouring states such as Penang, Selangor and Kuala Lumpur (Mun, 2007). In addition to the mining industry, Perak has an established agriculture and fishing industry. On a geographical side, rubber plantations are found in the central area of the region, rice fields in the Northwest and South and palm oil plantations at the border with Selangor: this is also represented in the land use of Perak, which exists mainly of agriculture (see appendix 2.2). In the last few decades, however, the State has undergone economic structural changes. In fact, during the 1980s and 1990s, manufacturing and services began to replace agriculture and mining as prime economic drivers (InvestPerak, 2016).

When zooming into the cities, their profile can be described in terms of administrative, cultural and economic characteristics. In this section of the research, an introduction to a selection of cities and districts that are central in this research is provided to contextualize the locational area of our study.

Ipoh

With a population of over 700,000 in 2016 (Perak Data Asas, 2016), Ipoh is the largest centre in Perak, and it is recognized in the State Structure Plan as the State capital (Perak State Structure Plan 2020). Originally a tin mining town, Ipoh is emerging as regional service and manufacturing centre. Main functions include public, retail, health and education services. It is also the state's administrative centre, where most state agencies are located (Geografia, 2015).

Taiping and Kamunting

Taiping is located north-west of Ipoh, with a 1-hour travel distance by car. Other than a district-level administrative, services and commercial centre, Taiping is featured by heritage, culture, tourism, recreation and education assets serving as supplementary functions (Perak State Structure Plan 2020). Kamunting forms a satelite town of Taiping. In this research, Kamunting and Taiping are merged as one urban area, Taiping-Kamunting. Together, these cities have a combined population of over 200,000 and form the second-largest urban area (Perak Data Asas, 2016).

Lumut-Sitiawan

The thirds largest urban area is Lumut-Sitiawan, sometimes referred to as Manjung, with a population of about 200,000 (Perak Data Asas, 2016). This area is located south-west of Ipoh, with a 1,5-hour travel distance. Lumut is strategically located on the coast. Its main asset is recognized in the secondary port and bulk terminal, which includes a shipbuilding and repair industry (Geografia, 2015). In this research, Lumut and Sitiawan have been merged as one urban area. The surrounding agriculture is centred on palm oil plantations. The industrial character of Lumut is also reflected in its land-use patterns.

Seri Iskandar

In between Ipoh and Lumut-Sitiawan lies Seri Iskandar, a relatively small place, with a population of about 50,000 in 2016 (Perak Data Asas, 2016). A large share of this population exists of students, which can be explained by the fact that the town hosts several universities, namely the MARA University of Technology, Kolej Profesional Mara Seri Iskandar, Institute Kemajiran Belia Negara and the University Technology Petronas (Geografia, 2015). It is known for its role as a higher education centre, which is reflected by a high proportion of institutional land use.

Teluk Intan

Teluk Intan is the most southern city in the study area, located alongside the Perak River, 1,5-hour travel distance south of Ipoh. This city is the fourth largest city, with a population of about 100,000 in 2016 (Perak Data Asas, 2016). Compared to the three largest cities, the built-up area is relatively small. Travelling north towards Ipoh, you come across Bidor, Tapah, Kampar and Gopeng. These cities are somewhat smaller and are mostly identified as local centres.

2.5 Spatial management plans

In the third Malaysian National Physical Plan (NPP3), a spatial growth framework for Perak is introduced. This spatial development plan aims to efficiently manage the growth of urban areas and ease the proposal applications for future land development proposals. Growth areas are divided into different categories, in which Ipoh and Lumut-Sitiawan are identified as Promoted Development Zones (figure 4). The goal is to strengthen the role of these cities as development catalysts and to encourage integrated development in rural areas. One of the ambitions mentioned in the spatial growth framework for Perak is to achieve more balanced urban growth and holistic land use development (JPBD, 2016). The findings of this research suggest that these ambitions have not yet been realized.

3.Theoretical framework

Aim of this research is to develop insights into the characteristics of the regional structure of Perak's urban system. To verify whether the current regional structure of the 'Perak Diamond' indeed can be characterized as polycentric, it is crucial to become familiar with the conditions that indicate this structure. Therefore, the first section of the theoretical framework on the concept of polycentric urban regions (PURs), from a morphological perspective. The second section explains how built-up forms of individual centres – on a lower scale level – influence the efficiency of polycentric structures. The last section focuses on the processes that guide and influence land- and real estate development, as this impacts urban form. Finally, the conceptual model is presented.

3.1 Polycentric urban regions

A substantial amount of research literature addressed the concepts of 'polycentricism' and 'polycentric development'. As explained by Vasanen (2012), research on the subject is in development, and multiple definitions of the concept exist. The difficulty in defining the concept has to do with the fact that polycentrism is interpreted differently by diverse actors and on different scale levels (Meijers, 2008; Vasanen, 2012; Davoudi, 2003). An urban system can be polycentric at one scale, while it may be monocentric when examined at another scale (Vasanen, 2012; Hall & Pain, 2006; Taylor, Evans & Pain, 2008). Because of this scale-dependency, different studies analyse polycentrism as different levels.

Traditionally, the concept is applied on a scale of the city level (Robert et al., 1999) or an intra-urban level (Garreau, 1991; Anas, Arnott & Small, 1998; Bontje & Burdack, 2005). The concept of polycentric development is also applied on the European scale, as the European Spatial Development Perspective stated that "creation of several dynamic zones of global economic integration, well distributed throughout the EU territory and comprising a network of internationally accessible metropolitan regions and their linked hinterland (towns, cities and rural areas of varying sizes), will play a key role in improving spatial balance in Europe" (EC, 1999, p. 20).

More recent studies (Hall & Pain, 2006; Meijers, 2007; Kloosterman & Musterd, 2001; Burgalassi, 2010; Bergsli & Harvold, 2018) applied the concept of polycentricity on a regional level, usually referred to as a polycentric urban region (PUR). PUR refers to "an interurban scale where a dense network of distinct but adjacent cities exists without a clear leading centre" (Vasanen, 2012, p. 3628). Other studies on regional polycentricism also refer to a *balanced and equal distribution* of cites (Kloosterman & Lambregts, 2001; Meijers, 2008).

In this thesis, this regional scale level forms the context of the analysis, with a focus on the morphological dimensions of polycentricity.

3.1.1 Morphological polycentricity

Urban morphology studies the form of human settlements and the process of their formation and transformation. Within the field of urban morphology, different approaches are used to understand the diversity and complexity of human settlements (Kropf, 2009). A multidisciplinary approach towards studying urban settlement transformations can be efficient. In fact, a morphological approach "should be an independent study that makes use of findings of all the other sciences, co-ordinating them under the unifying aspect of form" (Kropf, 2009, p.105). This research will use a multidisciplinary approach to identify the presence of a potential morphological polycentric structure.

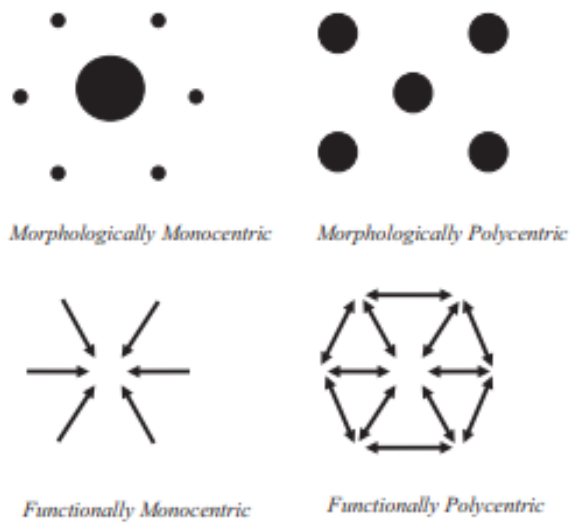


Figure 5: Morphological polycentricity vs functional polycentricity. *Source: Burger & Meijers, 2012*

In morphological terms, the concept of polycentricity refers to several centres that are located in the same urban system (Vasanen, 2012; Taubenböck et al., 2017; Burger & Meijers, 2012). Other studies emphasize another requirement for polycentricity, namely the functional linkages between centres in an urban system, such as commuting patterns (Burger et al., 2011; De Goei et al., 2010; Vasanen, 2012) and social networks (Green, 2007). However, as this thesis studies the case study area from a morphological perspective, the focus is strictly on the morphological dimensions of polycentricity.

From a morphological perspective, "polycentricity tends to be more closely associated with a balanced distribution with respect to the importance of these urban centres" (Burger & Meijers, 2012, p. 1132). This is also mentioned by Meijers (2008), who states that "morphological characteristics such as the size and spacing of cities are determining factors in establishing whether or not any given area is polycentric or the opposite, monocentric." (Meijers, 2008, p. 1319).

Based on the above, it becomes clear that a polycentric regional structure is characterized by *the lack of hierarchy* in terms of size among urban centres. Therefore, morphological polycentricity can be distinguished from other regional spatial structures such as 'multicentric regions' or 'monocentric regions', given the importance of a *balanced distribution* of compact centres (Burger & Meijers, 2012; Burgalassi, 2010). Besides this, a polycentric region is characterised by open space between the centres, such as rural or agricultural land. This research adds a third scenario to the possibilities of urban configurations: *the archipelago system*. In a rather simplistic way, this configuration can be described as a mix of the monocentric and polycentric scenarios. In fact, in an archipelago system, sub-regional units are not organized according to a particular hierarchy but show a rather random pattern of autonomous developments. In this research, such scattered spatial structures are defined as an 'archipelago structure', referring to a cluster of remote and isolated islands.

3.1.2 Quantifying morphological regional structures

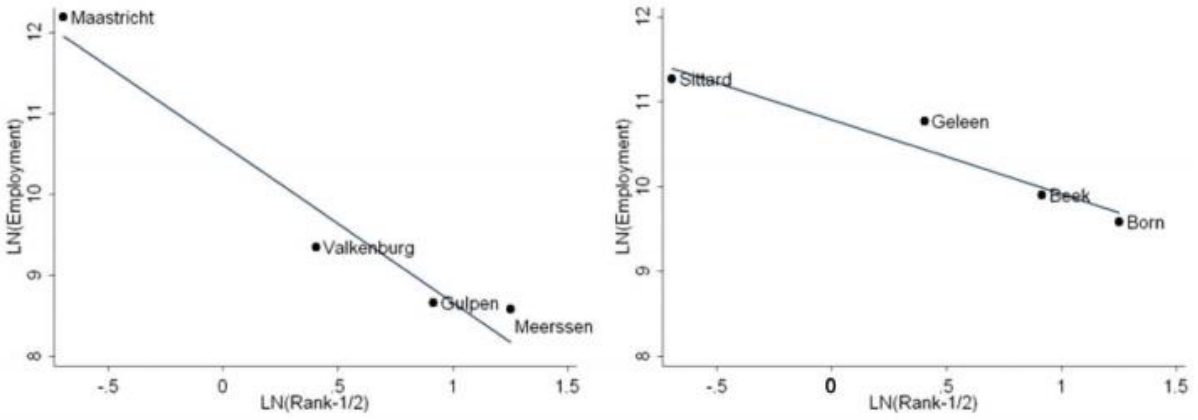
Previous studies used different approaches to analyse and define (sub-) centres in an urban system. Some studies (Taubenböck et al., 2017) use a physical approach for analysing regional spatial structures, by reflecting on the physical evolution of built-up areas and its impact on population density (Xie, Hou & Herold, 2018). Other studies focus on the rank-size distribution of cities in an urban system, which provide information of the hierarchy of centres, which is a good indicator of the degree of monocentricity or polycentricity (Burger & Meijers, 2012; Vasanen, 2012). By taking into account the rank-size distribution of settlements, polycentric urban structures can be distinguished from monocentric structures. Spieckermann and Wegener (2004) have developed a definition of a PUR, based on the rank-size distribution of settlements in an urban system. According to this definition, polycentricity in a

region exists when the following *four requirements* are met (Spieckermann & Wegener, 2004):

- In a polycentric urban system, there is a distribution of large and small cities.
- In a polycentric urban system, the rank-size distribution is log-linear.
- A flat rank-size distribution is more polycentric than a steep one.
- A polycentric urban system is not dominated by one large city.

A rank-size distribution is used by Burger & Meijers (2012), to measure the presence of polycentricity in two Dutch regions. In such analyses, the slope of the regression line is the indicator for the degree of polycentricity in an urban region: the flatter the slope of the line, the more polycentric the region. In contrast to this, a steeper line suggests a more monocentric region (figure 6).

Figure 6: Example of rank-size distributions to identify characteristics of a monocentric regional structure (left) and a more polycentric regional structure (right). S*ource: Burgers & Meijers (2012).*



In this example, the size of places is measured based on employment data. A similar approach can also be used with other variables, such as population data (Sat, 2018). By comparing linear trends in an urban region for multiple time periods, it is possible to recognize characteristics of poly- or monocentric growth. These findings help to verify a crucial condition for regional polycentrism, namely that none of the cities in the regions should dominate in terms of population (Parr, 2004).

3.1.3 Relating critical mass with land development patterns

A general perception is that agglomeration economies - which is the spatial version of economies of scale - arise with city size (Boussauw et al., 2018; Hague & Kirk, 2003), as larger cities or agglomerations can "offer a large labour force with a range of skills, access to other firms, suppliers and services, including the kind of specialists unlikely to be found in smaller settlement" (Hague & Kirk, 2003, p. 3). To stimulate agglomeration economies, a certain "*critical mass* is deemed necessary for business, urban amenities and services to be able to diversify and function smoothly" (Meijers, 2007b, p. 15). In a region that consists of small- and medium-sized cities, a polycentric configuration can be desirable as it allows for enhancing more critical mass, by combining the urban mass of individual nodes. By 'borrowing size' from each other, under the condition that the nodes are well connected, these nodes can provide critical mass comparable with larger monocentric regions (Meijers, 2007b). This concept

of *size borrowing* is characterized by synergies and spill-over effects between the centres, generating a critical mass for agglomeration advantages in a region (Schmitt, Volgmann, Münter & Reardon, 2015). Such interactions are higher in denser built-up areas compared with sprawled urban areas (Glaeser, Ponzetto & Zou, 2016). A condition is access to adequate infrastructure, as agglomerations that are both internally as externally well-connected have more interaction potential (Alonso, 1971; Boussauw et al., 2018).

Compact urban development is a way to stimulate efficient growth and stimulates urban mass, which is a condition for agglomeration economies. *Therefore, it is assumed that gains from polycentric structures can especially be obtained if individual urban centres evolve in a compact manner, enhancing efficiency, characterized by a dense development pattern.*

Changes in population distributions and built-up areas can often be attributed to the impact of land- and housing development (Huang et al., 2017), as such developments reshape the existing urban form. As more housing units are added to the existing property stock, the population potential of an area increases. Concentrations of building construction in certain areas are therefore an indicator of in what directions cities develop. In turn, these growth patterns -on the qrban scale level- influence the *efficiency* of the regional structure of the urban system on a higher scale level. Therefore, it is relevant also to analyse land development patterns on the urban scale level and its impact on the compacts of the urban form. The next section elaborates on this idea.

3.2 Conceptualizing efficient urban form

Urban form relates to the physical structures of an urban area, in which built form is defined as "spatial relations of features built or modified by humans, encompassing both solid and void and including planted vegetation" (Kropf, 2009, p. 116). Urban form has multiple spatial dimensions, as explained by Ferreyra & Roberts (2018, p. 167), namely; the geometric shape of a city's urban extent; the internal structure of the city, determined by roads and transportation networks; and land-use patterns, which are determined by the spatial distribution of population and buildings. The built form of cities is shaped by land-use patterns, as mentioned by Ferreyra & Roberts (2018), who identify *built-up areas* as one of the indicators of land use. Land use patterns are useful to understand towards what directions physical urban structures evolve. This information is fundamental in urban-economic analyses, as patterns of built-up areas inform us about the productivity and efficiency of cities.

3.2.1 Compact structures and urban mass

Compact built-up forms are considered to have certain advantages over sprawled areas. Urban sprawl is a phenomenon that is characterized by low density outwards developments into undeveloped or greenfield areas, also known as urban extension (Osman et. al., 2017; Abdullah et al, 2009). Urban sprawl is considered economically inefficient, as it creates additional private, public and social costs that are not captured by the market (Frank, 1989). Additional costs that are directly related to sprawled developments are for example additional costs for the provision of infrastructure networks, such as roads, water supply and electricity.

Compact urban development, on the other hand, is characterized by developments within the existing physical barriers of the urban area, also known as infill developments, as new developments 'fill up' the

gaps within the existing built-up areas. This results in a denser built-up area. Different studies acknowledge the advantages of compact development, as it allows for "better land use and less urban dispersion, maintaining the open space between cities" (Burgalassi, 2010, p. 7). Ferreyra & Roberts (2018, p. 172) explain that "a fuller city where built-up area is denser (..) may be conducive to more interactions". The importance of human interactions is also addressed by Gleaser (1998), as it stimulates knowledge spillovers. Therefore, denser cities are thought to "improve labour productivity through better matching of firms and workers and enhanced interactions that facilitate the spread of tacit knowledge, both of which are thought to occur more easily the closer people and firms are to each other" (Ferreyra & Robbert, 2018, p. 167).

Also, significant cost savings regarding infrastructure supply (Thomson, Hoffman & Staniforth, 2003) and commuting costs (Wheeler, 2001) can be realized when compact urban development is realized, which allows for more sustainable transport energy consumption (Breheny, 1995). Urban form and transport modes also shape the provision of access to people, goods, services and information of cities. The easier the access, "the greater the advantages through economies of scale, agglomeration effects and network advantages" (Rode et al., 2017, p. 3).

It is for these reasons that it is relevant to include analysis of the compactness of individual urban centres in this research, as the benefits that arise from compact built-up form also allow cities to borrow size from each other more easily, which is a crucial condition to support an efficient polycentric regional urban system.

3.2.2 Measuring the compactness of urban centres

A question that arises is how to measure the compactness of an urban area. Analyses of land use are useful, as certain patterns within the boundaries of a city reflect the use of space and the distribution of populations (Ferreyra & Roberts, 2018). From a morphological perspective, urban analyses focus on these spatial distributions of buildings and populations. Cartographic sources, such as historic maps, are sometimes used to analyse urban development patterns, often supported by population data (Xie, Hou & Herold, 2018). Combining population data and with land use data allows for measuring the compactness of an urban area.

There are multiple ways to define urban density, depending on the aim of the research. Related to agglomeration economies, density is often measured as population per built-up area (Ferreyra & Roberts, 2018). According to the definitions of the European Commission, an agglomeration is an area with a population of more than 50,000 inhabitants in total and a density greater than 15 people per hectare built-up area. Areas that met these requirements are also qualified as urban centres (Dijkstra & Poelman, 2012). Identifying urban centres and sub-centres is usually the first step to understand the spatial organisation of cities or regions (Huang, Liu, Zhao X & Zhao P, 2017). Some studies (Xie, Hou & Herold, 2018) use these methods to analyse the emergence of centres over time. These types of studies use spatial data to derive time-series maps, which allows for the visualisation of growth in built-up areas as well as population and built-up intensity (Xie, Hou & Herold, 2018). By relating the densities of urban centres in a certain region (the study area) with the density of a more developed metropolitan area, the urban mass of the centres can be put in perspective. A similar approach is used in this research. As density and compactness of centres are impacted by (land) development patterns, the following section elaborates on the processes that guide and influence these developments.

3.3 Development processes: central actors, drivers and external influences

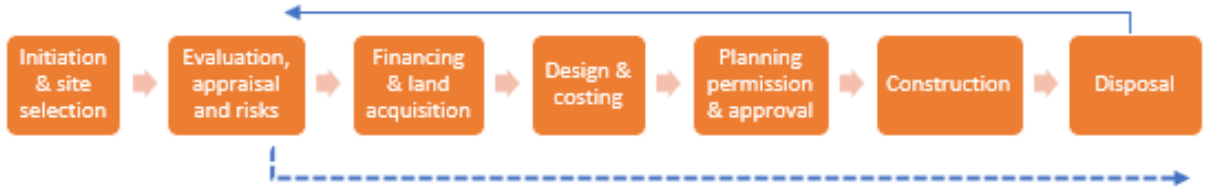
To understand locations decisions for new developments, and how this shapes the built environments, the whole development process must be understood (Healy & Barrett, 1990). This allows for the usage of tools of urban-economics, which analyses urban issues such as housing, industrial development, government expenditure and policies. Aim of such analyses is to understand the processes and drivers that influence urban development patterns (Quigley, 2008). Yeh & Wu (1996) explain that the form of an urban area is influenced by land development processes, as these processes directly impact real estate development. The processes of land- and real estate development are interrelated, but the difference must be understood, as the terms can easily be confused.

Land development refers to "how urban land is produced in the form of both buildings and sites for various activities" (Yeh & Wu, 1996*).* From the Malaysian land administrative perspective, land development is defined as "the change of original use of any alienated land that affects its restriction in interest, express conditions and category of land use as opposed to what has been earlier approved by the State Authority upon alienation" (NHCSB, 2009, p. 1). This definition will be used in this thesis. So, land development relates to those situations in which land, that is acquired for building purposes, is currently in agricultural status, and where an application for the conversion of land use status must be obtained before any development is allowed.

The term real estate development, or property development, includes all phases that are part of the development process, from land acquisition to the selling phase. Wilkinson & Reed (2008, p. 16) define property development as "a process that involves changing or intensifying the use of land to produce buildings for occupation". The type of buildings can differ from industrial or commercial buildings to housing schemes and schools. Generally, several phases in a development process can be distinguished (Cadman, 2002; Wilkinson & Reed, 2008). It is crucial to have a good understanding of these different development phases, as each phase is influenced by other actors and the market.

In the first phase, developers – or state agencies in the case of affordable housing projects - look for a suitable location. As every land plot is unique and has its own characteristics, a consideration of the suitability of the location will be based on different location factors. In the next phase, prior to the acquisition of a development site, the developer focusses on development appraisal and considers the risks. Risk management will be central during the entire process, as the developer will constantly evaluate the profitability of the development. Next, the developer needs to gather financial resources, either via bank loans, own capital or other financial constructions, such as Real Estate Investment Trusts (REITs). This capital is required to purchase land; for the construction costs; and for other fees. After this, the project's costs and design are described in detail and delivered to local authorities. The approval of local authorities results in the final building permit. It is only after these phases that the actual physical development of a building takes place, during the construction phase. After completion, the building is disposed either through sales or rental constructions. This phase, however, starts often earlier, as most developers sell units in advance, to secure future cash-flows and reduce risks (Cadman, 2002; Wilkinson & Reed, 2008; Graaskamp, 1981).

Figure 7: Different phases in the development process. *Source: authors own illustrations.*



3.3.1 Main actors involved in the development process

Studies on land development should consider the role of land ownership, the organisation of the construction industry, the nature of finance invested, and actors involved in a development process, such as the government, constructors, developers and consultants (Healey & Barrett, 1990). Within a development process there is a relation between structure and agency. While the former relates to the drivers of developments and how this produces developments patterns over time, the latter considers the ways in which individual actors develop and pursue their strategies (Healey & Barrett, 1990, p. 90).

This section elaborates first on the actors involved in a process and explains their personal drivers. The next section elaborates on the external drivers and factors that influence development processes, or in other words, the development context.

Actors involved in a development process are and land-owners, developers, investors, constructors, consultants, (local) governments, planning agencies, and local communities. The way these actors or agents operate is influenced by 'the various resources to which agents may have access, the rules which they consider govern their behaviour, and the ideas which they draw upon in developing their strategies' (Healey & Barrett, 1990, p. 90). The complexity in the role of actors lays in the fact that each of them holds their own ambitions related to the development. While the purpose of a *developer* is usually clear, namely to make financial profits from the development, other actors might have other ambitions (Wilkinson & Reed, 2008). *Landowners* may be actively involved in the development process when they aim to increase their land value. In other cases, the landowner needs to cooperate unwillingly, as part of a developer's strategy (Wilkinson & Reed, 2008). *Financial institutions* are often involved when the developer doesn't have enough financial capital. Financial institutions might differ from pension funds to banks or even society. Goals of the *governmental agencies* might differ, as sometimes they stimulate developments in order to provide sufficient housing for community use, while other times they aim to increase cash-flows from land taxes. Sometimes, joint-ventures between governmental agencies and developers are formed, most often in cases when both parties can profit from this. These Public-Private Partnerships (PPP) can be part of governmental strategies, such as the realisation of high-quality affordable housing (Wilkinson & Reed, 2008). In such joint-ventures, governments stimulating developments by contributing to financial capital or land availability, while the developer is responsible for the realisation of the project according to the government's plan. Governments require solid strategic regional planning to support future spatial development of a polycentric urban region (Boussauw et al., 2018). *Planning agencies* play another important role, as they are a major regulator for new developments. Finally, *occupiers* play a role, as their preferences for housing types and locations, and the amount they are willing to pay influences certain choices in the development process.

Besides the main actors involved in development processes, other professionals have supporting tasks. Such a professional team consist of architects, contractors, consultants, project managers, engineers, surveyors and agents. The involvement of all these different stakeholders in a development process makes it a rather complex process to analyse. In this research the focus will therefore only be on the roles of the main actors involved in development processes in the case study area, and less so on the supporting actors.

3.3.2 Development context: external drivers and influential factors

According to Wilkinson & Reed (2008), real estate development does not occur in a vacuum, as it is influenced by external factors, both on the demand as the supply side.

The economic and political context

The status of the economy is directly related to the property market. Residential prices and land costs, in turn, determine the profitability of developments, in combination with the construction costs. These factors directly impact the development process. Besides personal motives of developers, this external context influences and stimulates decisions of developers to choose for certain locations. Healey & Barret categorize external influential factors into three main categories, namely "(1) the resources for development, as channelled via the financial system and the interrelation of supply and demand; (2) the politico juridical rules which limit the construction of development opportunities; (3) the ideas and values people hold about what they should build, what they would like to occupy and what kind of environment they seek." (Healey & Barrett, 1990, p. 94).

On the demand side, potential occupiers depend on their incomes, which is reflected by the status of the economy. On the supply side, the status of the economy influences the access to financial resources. Access to financial resources and land also depends on the role of local governments and their willingness to lease land. In some parts in China, for example, the willingness of governments to lease land is influenced by tax revenue regulations and a decentralization process after China's economic reforms (Zhang, 2000).

Location factors and site selection

As real estate development is a site-specific activity, it is crucial to consider the location factors of a site, which are a fundamental aspect of the success of a development (Cadman, 2002). Different actors might take into account different location factors when selecting a construction site. State agencies, for example, might consider household incomes when selecting a site for an affordable housing project. Developers can have different motives, such as low land costs. It can also be the case that actors work together in joint-ventures.

Joseph, James & Neil (2001) identify multiple location factors that can influence site-selection processes, such as the physical suitability for development (quality of soils and land availability), access, distance to employment sources, and government regulations, such as zoning and other land-use controls. Other examples of location factors are land costs, the growth potential of the location and the presence of other facilities. The availability of infrastructure is a crucial location factor, as insufficient access to roads, water supplies, and electricity determine the development potential of a location. Insufficient accessibility will provide additional costs.

However, related to the latter, developers sometimes have misperceptions about such additional costs and underestimate the efficiency of building on highly accessible locations. As prices for real estate and land can vary enormously across locations (DiPasquale & Wheaton, 1996), with often lower land prices in rural areas, land costs are an important driver of urban sprawl. Land prices also affect location decisions for affordable housing projects, as governments often locate such projects on low-cost peripheral land. In Penang, Malaysia, for example, developers have financial motives to build in greenfield areas, because of the assumption that development costs are lower, compared to development projects on the cities' edge or within cites (Osman et al., 2017). This is interesting, because 'the reality is that cost of sprawl studies show that substantial infrastructure costs savings can be achieved by increasing urban densities and locating new development near existing built-up areas' (Osman et al., 2017, p. 23).

Land management and zoning plans

According to the UK's Royal Town Planning Institute, urban planning is the most important tool governments have for the management of urban growth and expansion (Xie, Hou & Herold, 2018), in which zoning plans, which is the division of land use in different categories, are a tool to guide developments in certain directions. Planning agencies are not only responsible for the *formation* of local plans, but they also approve or refuse applications for permission. These decisions of local authorities are influenced by (regional) development strategies of state authorities, as well as own ambitions of the local municipality.

Locations that allow for new developments should strategically be considered by urban planners if they wish to achieve polycentric development (Boussauw et al., 2018). Zoning plans are a tool that land managers and urban planners can use to guide developments towards certain direction. To stimulate the mass and interactions of an urban area, new developments should be organized in a compact and less car-dependent matter. To prevent low-density inter-urban developments, (local) authorities should select a limited number of growth centres. Also, compact development can be facilitated "through plan-imposed scarcities on the land market" (Boussauw et al., 2018, p. 19), for example by creating zoning-plans that only allow for developments on brownfield or intra-urban locations.

Effects of loopholes

The efficiency of zoning plans can sometimes be discussed, especially when urban planning and development control regulations cannot be fully enforced, giving rise to *loopholes,* which can be defined as an inadequacy in the law or a set of rules (Hao, Sliuzas & Geertman, 2011). It is argued that loopholes in the development control- and permission system allow for sprawled development patterns (Sorensen, 1999). The failure of planning systems to consolidate development within urban promotion areas can have fiscal explanations, for example when land hoarding is rewarded by loopholes in land taxation systems (Shapira, Masser & Edgington, 1994).

Often it is the case that urban land is tightly regulated in terms of planning and construction, while rural land is autonomously managed, which leads to loopholes in regulating land use. This is especially the case in rural-urban transition zones, close to borders of a city (Hao, Sliuzas & Geertman, 2011). The identification of loopholes in a (local) planning system is relevant to understand the power of state- and local authorities to guide urban development in an efficient manner.

3.4 Conceptual model: scenario's and conditions

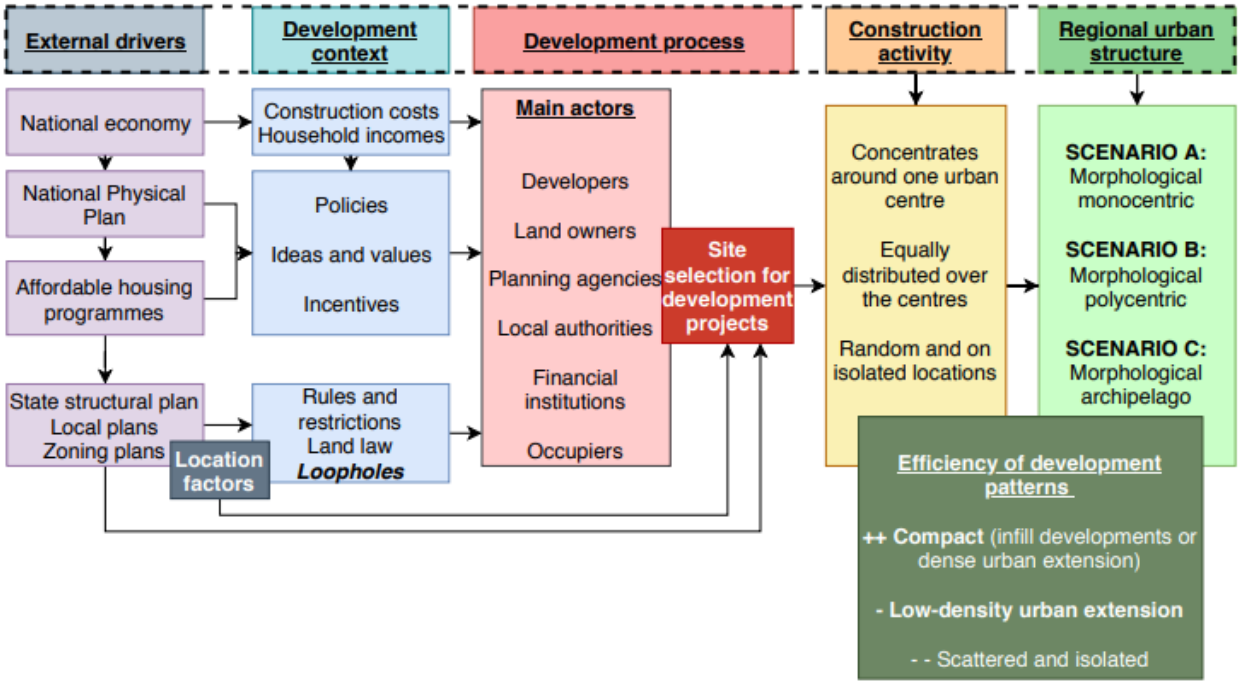
This research studies how land development patterns shape the regional urban structure of the study area. For a more comprehensive understanding of changes in built-up areas, the research also focusses on the actors and drivers that influence development processes. By combining this approach with the 'traditional' methods to analyses morphological urban structures, such as rank-size distributions, it is possible to identify the spatial characteristics of the regional urban system. Based on the theory, three scenarios have been distinguished:

A. Urban development patterns in the region indicate a *morphological monocentric regional urban structure*, with one dominant centre.
B. Urban development patterns in the region indicate a *morphological polycentric regional urban structure*, with an equal distribution of centres over the region.
C. Urban development patterns in the region indicate a *morphological archipelago regional urban structure*, characterized by scattered, non-continuous developments that are located on a considerable distance of existing built-up areas.

Note that in the scenario of an archipelago structure, the *distance element* plays an important role, as isolated developments demand significant investments in infrastructure, to make these locations accessible.

It must be understood that the scenarios are analysed on a regional scale level. The *efficiency* of the regional urban structure is determined by development patterns on the lower spatial scale level. For example, an *efficient* polycentric configuration is characterized by compact and dense centres, while an *inefficient* polycentric configuration is characterized by low-density density sprawled centres. Therefore, development patterns on the urban level are also included in the analyses. The conceptual model visualizes the drivers that influence developments processes and the conditions for each scenario (figure 8).

Figure 8: Conceptual model. *Source: authors illustrations.*



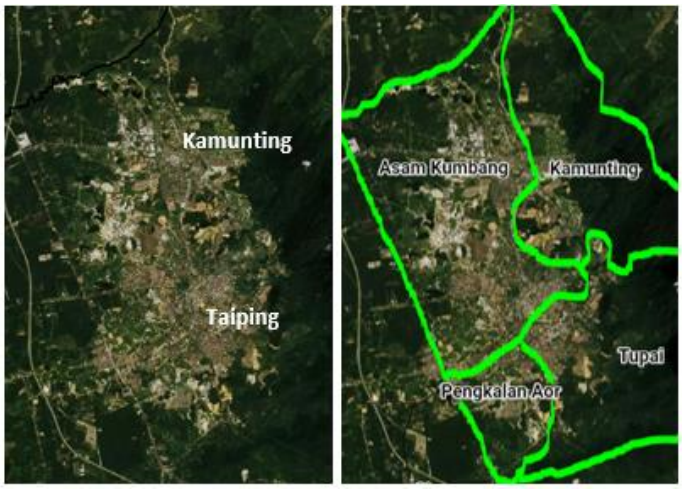
4. Methodology

This research follows a case study approach, which enables in-depth, multi-faceted exploration of complex issues in their real-life settings (Crowe et al., 2011). Aim of this chapter is to provide the reader with an overview of the materials and methods that have been used for this research. Because of the mixed-method approach of this research, multiple paragraphs discuss the materials and methods, corresponding with different topics. The combination of these methods allows for an in-depth analysis of the morphological urban dimensions in the study area.

4.1 Defining urban areas in the study area

Data sources used for this research operate on different scale levels (*national level; the state level; the mukim- or subdistrict level; and the municipality level).* The lowest spatial scale level which is available for most data sources is the mukim level. According to the Khazanah Research Institute (KRI, 2019), this spatial scale level allows for the most meaningful analysis. As some data in this research are merged, it was necessary to define the urban areas based on the mukims for a consistent approach towards the data. Also, as the physical structure of some cities overlaps, urban areas are defined based on their physical structure and the corresponding mukims, rather than by their administrative boundaries. For example, Kamunting and Taiping are two separate cities according to their administrative boundaries. However, considering the built-up areas or the physical boundaries of these cities, together they form one urban area (figure 9). Therefore, this Taiping and Kamunting are defined as the urban agglomeration 'Taiping-Kamunting'. An overview of the defined urban areas and the corresponding mukims can be found in appendix 3. In total, thirteen urban areas have been defined, which form the basis for further analysis in this research.

Figure 9: Kamunting and Taiping form one physical urban area. The lines represent the administrative boundaries of the corresponding mukims. *Source: authors illustrations and Google Earth (2019).*



4.2 Population growth and density patterns: data, assumptions and formulas

Population data is obtained from the Malaysian Housing and Population Census, for the years 1991, 2000 and 2010. The Malaysian Housing and Population Census is a national census, which is held every ten years. The national census is considered as the most precise when it comes to population data in Malaysia. The census offers population statistics on different scale levels: national level; state level; district level; mukim level (subdistrict); and the municipality level. For the mukim-level, only census data for the years 2000 and 2010 could be obtained. Because the next census is held in 2020, more recent population data were obtained from other data sources. By combining these datasets, a more comprehensive picture of demographic dynamics in Perak during the last decade could be offered.

Furthermore, recent population estimations are also needed for density calculations, as will be discussed in more detail later, since land-use data is available for 2018 only. For the district level, population estimations for 2020 were obtained from the 'Draf Rancangan Struktur Negeri Perak 2040 (DRSNP 2040)', a recent report that forecasts transformations in the regional structure of the Perak state until 2040. Because this report does not offer population data on the mukim (sub-district) level, an additional dataset is used. For the mukim level, data was obtained from the Perak Housing and Property Board, in the report 'Data Asas: Basic Data Negeri Perak Darul Ridzuan 2016'. This report offers population data on the mukim-level for the year 2016, the most recent that exists.

4.2.1 Adjustments on the district level

Because of changing administrative boundaries of some districts in 2016, population data had to be adjusted, so it corresponds with new official administrative boundaries. In the time period 1991-2019, some of the districts merged, while others split up and became autonomous. The Selama district is an autonomous district within the Larut, Matang & Selama district. While some consider Selema as separate from Larut dan Matang, most of the times it is considered as one district. Therefore, in this research, the Larut dan Matang district is merged with Selama. Until 2015, the Perak State exists of ten official districts. In 2016, two districts, Hilir Perak and Batang Padang, lost size, because parts of them became autonomous districts. The Mualim district split up from the Batang Padang district and became autonomous. The Bagan Datuk district split up from Hilir Perak district and also became autonomous. To show these changes, a distinction has been made between the period before 2016 (the Perak State with ten districts) and the situation after 2016 (the Perak State with twelve districts). Population growth calculations have only been applied to scenario before 2016 when Perak exists of ten states. Another variable is the area size per district in hectares, which is necessary for calculation of population densities on the district level. This data is obtained from both the DRSNP 2040 and from the population census data reports.

4.2.2 Adjustments on the city level

Other adjustments that have been made related to population numbers per urbanised area. The population census offers for some cities population data on the municipality level. However, this data is insufficient for this research for multiple reasons. Firstly, population data on the city level is incomplete, because the data is only available for a few cities in Perak. For the cities that do have population data, it is not always clear which administrative boundaries have been used. Secondly, the population data that is based on the municipality boundaries, do not always overlap with the boundaries of the physical urban area. Indeed, the population per municipality also includes towns located in other parts of the districts.
As population data is available on the mukim level, it is possible to calculate the total population of an urban agglomeration, by adding up the population numbers of the mukims that overlap the built-up area. It must be said that by doing so, it might be the case that also a part of the population living in rural areas will be included in the total sum. However, it offers a good indication of the population living in different urban areas in comparison to each other. Also, population data on the mukim level corresponds with land-use data, as this data is also available on this scale level. This approach offers a more consistent approach towards populations data in the study area on the urban level.

4.2.3 Population growth formulas

Population growth rates have been calculated using the same formula as in the National Housing and Population Census, where the average annual population growth rate has been calculated as follows:

$$r = \left(\frac{1}{n} ln \frac{P_n}{P_o}\right) \times 100$$

Where:

r = the average annual population growth rate
n = the exact number of years between P_o and P_n
P_o = the population at the initial year
P_n = the population at the later year
ln = the natural logarithm

The average annual population growth rate is calculated for both on the district- as the city level for multiple time periods. By doing so, the degree of urbanization could be explained. This research also examines changing patterns of population distribution in the form of a rank-size distribution, by ordering the different urban areas in the study area based on their absolute population size. The linear trends that follow from these analyses are compared for the years 2000, 2010 and 2016. By doing so, characteristics of mono- or polycentric growth could be determined, based on the (un)equal distribution of populations.

4.2.4 Population density per built-up area

The population density for each urban centre has been calculated, based on the built-up surface and population data. For a consistent approach towards these calculations, both the land use data as the population data are based on corresponding mukims. The land use data is obtained from the 'existing land use' database of JPBD for the year 2018. To calculate the built-up surface for each urban area, the following formula has been created:

$$BU_y = (TL_1 + TL_2 + TL_X) - (NU_1 + NU_2 + NU_X)$$

Where:

BU_Y = Total built-up surface of urban area Y (based on the corresponding mukims)
TL_X = Total land use in hectares of mukim X
NU_X = Total non-urban land use in hectares of mukim X (*Water, Forest, Agriculture, Vacant land)*

After this, the population density of each urban area is calculated, defined as *the number of people per hectare built-up surface.* As the most recent population data on the mukim level is from 2016, the years do not overlap exactly. However, it could be expected that the built-up area did not change that much in two years. Therefore, this is still a useful indicator of population density. The population density is calculated as follows:

$$PD_Y = \frac{P_y}{BU_y}$$

Where:

PD_Y = Average number of people per hectare built-up surface of urban area Y
Py = Total number of people living in urban area Y
BU_Y = Built-up surface of urban area Y, based on corresponding mukims

4.3 Global Human Settlement Layer

For the visualisation of urban centres and to detect changes in density of urban areas over time, spatial data of the Global Human Settlement Layer (GHSL) is used, which builds upon the Degree of Urbanisation, a definition used to outline the spatial extent of cities and settlements (Florczyk et al., 2019). The GHSL offers open-source data from the European Commission (2019) which is created by various input sources such as satellite imagery, census data and other geographical information (Melchiorri, Pesaresi, Florczyk, Corbane & Kemper, 2018). The layer used for the detection of centres is the GHS-SMOD geospatial layer, which classifies urban areas in three categories, namely urban centre, urban cluster, and rural area. The data is visualized by means of online software of the European Commission (2019). The data covers four time periods: 1975, 1990, 2000, 2015. Visual comparison of time-series maps allows for the detection of changes in built-up density over time, which is a relevant indicator of the efficiency of land use.

Urban centres in the GHSL are defined as a high-density cluster with a density of minimum 1,500 inhabitants per km^2 grid cell *or* at least 50% built-up surface share per km^2 of land surface, *and* a total minimum population of 50,000. An urban cluster is a dense or semi-dense area with a minimum of 300 inhabitants per km^2 grid cell *and* a total minimum population of 5000 inhabitants. Rural settlement cells have more than zero inhabitants per km^2 land surface *and* a total population of fewer than 5000 inhabitants (Florczyk et al., 2019, p. 13; Dijkstra & Poelman, 2012).[4]

To understand how land and real estate developed shaped the existing built-up areas over the years, a multi-temporal visualisation of built-up area expansion is used. Data for this analysis comes from the GHS-BUILT spatial information layer (Corbane et al., 2018). Again, the data is visualized using the online software of the European Commission (2019). The built-up areas are visualized for the years 1990, 2000 and 2015 for each urban area in the study area. By means of visual comparison of the maps, spatial land development trends can be detected. These analyses allow for the detection of urban sprawl phenomena, urban extension patterns or infill developments. This information is useful to understand outcomes of population density, and how land development patterns influenced the compactness of urban areas over time.

Figure 10: Feathers of the GHSL dataset. *Source: Melchiorri et al. (2018).*

Name	Semantic	Grid Resolution	Epoch [1]	Main Input Data
GHS-BUILT	Density of built-up area per grid cell	30m, 250m, 1km	2015, 2000, 1990, 1975	Satellite imagery
GHS-POP	Population counts per grid cell	250m, 1km		Census data, GHS-BUILT
GHS-SMOD	Classification of each grid cell into one of the Settlement Model classes: high density cluster, low density cluster, and rural cells	1-km		GHS-BUILT, GHS-POP

[4] Note that in this thesis, the standard measuring unit used is 'hectares' (instead of square kilometre). This decision is based on the fact that local data sources in Malaysia mostly use this measuring unit.

4.4 Spatial analysis of recent building construction

This paragraph discusses the methods and materials used for spatial analysis, both on the regional- as local scale level.

4.4.1 Existing property stock and incoming supply

For insights in the property stock on the *district level*, data from the National Property Information Centre (NAPIC) are analysed. The data sources used are the 'Residential Property Stock Table Q3 2018', 'Industrial Property Stock Table Q3 2018' and the 'Commercial Property Stock Table Q3 2018'. This data offers insight into the supply of *commercial, housing and industrial* units per state and per district. The reports make a distinction between *existing stock and planned supply.* Comparison of this data for different districts allows for the detection of which district is the most active in terms of property developments, and whether this differs between typology.

The property market reports have two limitations. First, only the reports for 2018 could be retrieved, it was not possible to analyse trends during different periods. Second, as the data is only on the district level, no spatial analyses on the urban level could be performed. Therefore, this data by itself is insufficient to get insight into spatial patterns of real estate development and its impact on urban form.

4.4.2 Spatial analyses of development permits

For a spatial analysis of housing development during recent years, development permits have been obtained from the Perak Housing and Property Board (LPHP), which is the agency for granting building permits. For this research, the '*Advertising Permit and Developer's* Licence' (APDL) was considered to be the most relevant, as this type of permits gives most insight in where actual building construction is located. This type of permit is granted to developers that wish to sell at least 70% of the total units of a project in advance. As most developers in Perak operate this way, this type of development license is the most accurate indicator for where development takes place, as this license is granted close to the actual construction phase starts. The dataset exists of *all the approved APDL's for housing projects in Perak during the years 2013-2017,* which is the most up to date dataset available. The dataset consists of 1264 APDL's in total. For each licence, additional information is available. The variables used for the spatial analysis are *the year of permission; location (district, mukim, postal code); number of units; minimum selling price; maximum selling price.* For the mapping of the data, the '3D map plugin' of Excel has been used, which allows for the creation of heat maps. The results indicate in which areas in the study area the highest concentrations of housing construction took place during the years 2013-2017. Also, it allows for the visualisation of differences in house selling prices per urban area.

Limitations of the spatial analysis of APDL's is that the lowest spatial scale-level available is the postal code. Therefore, the exact locations could not be visualized. Therefore, this dataset offers no insight into how housing developments impact physical urban form. Besides this, no differentiation could be made between locations of different types of development project.

4.4.3 Fieldwork and location visits

In order to deal with (spatial) limitations of the previously mentioned data sources, numerous field trips have been made to the study area. Preparation of the field trip was done by identifying construction locations, using time series mapping of Google Earth. Visual comparison of maps allows for the detection of construction sites per urban area (figure 11). The locations were visited for confirmation

and to achieve additional information, such as the type of development. Construction projects have been classified into six categories. *Residential projects* are those that exist only of housing units. *Mixed-use projects* exist of both residential as commercial units. *Commercial* projects exist only of shops or offices. *Industrial projects* are industrial premises or other industrial buildings, sometimes supported by shophouses. *Township projects* have been defined as such by the developer; these are large projects with a combination of housing and commercial units. These differ from commercial projects because these projects are much larger in size and also provide facilities, such as shopping malls, new roads and gyms, and are therefore most often self-supporting towns. The last development category is *other,* in which other types of developments, such as schools, are classified.

Figure 11: Visual comparison of time series maps to identify construction sites. Example of the progress of a building site in Ipoh during 2014, 2017 and 2019*. Source: Google Earth (2014, 2017 and 2019).*

Additional information was provided by 'information boards' at the gates of most construction sites. Relevant information on these boards was *the name of the developer, and the number of units constructed.* As sometimes this information was lacking, *secondary resources* have been used to gather the information per project, through websites of developers or via personal conversations. Also, for each project, the land consumption (in hectares) was measured by using the 'measurement tool' of Google Earth.

4.5 Development context

To get more insight into the processes and drivers behind the developments, the findings are supported by multiple resources. As land costs are an important driver for most developers, land costs transactions in the study area have been analysed. This data was obtained via the Valuation and Property Services department (JPPH), which officially records property transactions once the stamp duty for the sales and purchase is paid. These officially recorded transitions are available since 2014 and are updated on a monthly basis. The transactions represent sub-sale transactions of land, per urban area.

For a better understanding of the processes and actors behind the developments, six interviews have been conducted, some more comprehensive than others. The actors that have been interviewed operate both in the public- as the private sector and have been selected based on the information needed. An overview of the interviewees and their function is presented in the chapter 'References' (page 82). Besides these interviews, personal conversations during field trip offered additional information.

A workflow-model has been created to provide the reader with a summarized overview of the methods used in this thesis, which can be found in appendix 1.

5. Population distributions and urban growth patterns

Aim of this chapter is to show population distributions and growth patterns in the study area, both on the district as on the city level. On the city level, this data is combined with the built-up data, to calculate population density of the urban centres, which is used as an indicator to 'measure' urban mass.

5.1 Analysis on the district level

In 2010, Perak had a total population of 2,258,428, which is expected to rise towards 2,605,300 in 2020 (table 1). Considering the average annual population growth rates in Perak, it can be observed that the population in Perak increased since 1991, and more rapidly in the last two decades. In the 1991-2000 period, the population of Perak grew annually 0,55% on average, while the growth rate in 2000-2010 and 2010-2020 was 1,35% and 1,43% respectively. Considering the district level, a couple of things stand out (table 1). Note that the Hilir Perak and Batang Padang districts, partly split up in two new districts in 2016: Bagan Datuk and Mualim became autonomous districts. From this moment onwards, Perak exists of twelve districts. For this analysis, the districts have been merged to the scenario of that before 2016.

Table 1: Population distribution and growth rates on the district level. *Source: authors calculations, data obtained from the DOSM (2019) and DRSNP 2040 (2018).*

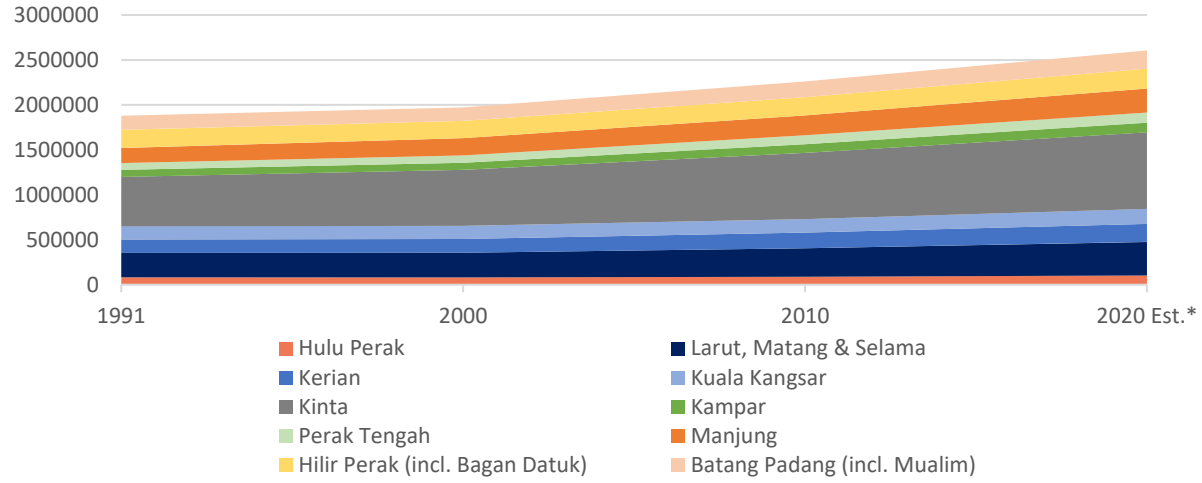
District	**Total population per year**				**Average annual growth rate (%)**		
	1991	**2000**	**2010**	**2020****	**1991-2000**	**2000-2010**	**2010-2020**
Hulu Perak	81,636	82,551	88,845	102,600	0,12	0,73	1,44
Larut, Matang dan Selema	271,882	273,641	315,285	371,900	0,07	1,42	1,65
Kerian	148,720	152,911	173,625	201,400	0,31	1,27	1,48
Kuala Kangsar	146,684	144,418	152,590	167,500	-0,17	0,55	0,93
Kinta	549,198	622,106	735,601	851,300	1,39	1,68	1,46
Kampar	78,701	81,387	95,402	107,100	0,37	1,59	1,16
Perak Tengah	75,574	82,153	98,897	114,100	0,93	1,85	1,43
Manjung	168,331	191,132	223,804	265,500	1,41	1,58	1,71
Hilir Perak*	202,059	190,868	201,168	221,600	-0,63	0,53	0,97
Batang Padang*	154,686	152,201	173,211	202,300	-0,18	1,29	1,55
Perak State (total)	**1,877,471**	**1,973,368**	**2,258,428**	**2,605,300**	**0,55**	**1,35**	**1,43**

*Notes: * adjusted to the situation before 2016 (Bagan Datuk & Mualim were not yet autonomous districts: therefore, they have been merged with Hilir Perak and Batang Padang); **2020 population is based on estimations from the DRSNP 2040;*

It can be observed that the 'Kinta' district is by far the largest, with an expected population of 851,300 in 2020 or 33% of the total population. The second-largest district in terms of population is 'Larut, Matang dan Selema', followed by Manjung. This can be explained by the fact that the largest cities of Perak are located in these districts. In the 1991-2000 period, three districts show a decreasing population, namely Kuala Kangsar, Hilir Perak and Batang Padang. In the next two decades, all the districts have been growing. Most districts grew the fastest in the 2010-2020 period, with an exception of Kinta, Kampar and Perak Tengah, which grew faster in 2000-2010. The Manjung district shows the highest

annual population growth rate in the last decade (1,71%). This corresponds with the growing population in the urban area of Lumut-Sitiawan, as will be discussed later. It can be observed that the population of Perak increased since 1991, and more rapidly after the year 2000 (figure 12).

Figure 12: Absolute population growth per district since 1991. *Source: authors calculations, data obtained from DOSM (2019) and DRSNP 2040 (2018).*



Considering the land area (measured in hectares), the population density for each district has been calculated. The results show that the Kinta district is by far the most densely populated, with an average density of 5,6 persons per hectare. However, this number is still relatively low, compared to Malaysia's most densely populated districts: Timar Laut (Georgetown area, Penang) and Kuala Lumpur (Bandaraya K.L.), which respectively have a population density of 43,7 and 69 people per hectare in 2010 (appendix 7.2 shows the administrative boundaries of these districts).

Table 2: Population density per administrative district. Based on the population of 2010. *Source: authors calculations, based on data of DOSM (2019) and DRSNP 2040 (2018).*

District	**Size in hectares**	**Population density (pop/hectare)**
Hulu Perak	656,000	0,1
Larut, Matang dan Selema*	211,300	1,5
Kerian	92,100	1,9
Kuala Kangsar	256,400	0,6
Kinta	130,500	5,6
Kampar	67,000	1,4
Perak Tengah	127,900	0,8
Manjung	111,400	2
Hilir Perak (incl. Bagan Datuk)	174,400	1,2
Batang Padang (incl. Mualim)	272,800	0,6
Timar Laut (Northeast Penang)	*11,900*	*43,7*
Central Kuala Lumpur (Bandaraya K.L)	*24,300*	*69*
Perak State (total)	**2,099,800**	**1,08**

** Note: the districts Larut Matang and Selama have been merged, as Selema is officially considered to be part of the 'Larut, Matang dan Selama' district.*

The next paragraph discusses population distribution is Perak on a lower scale level, namely on the city level, in this research defined as urban areas. These analysed urban areas are that form the central areas in the study area, which are located in the districts Kuala Kangsar, Larut Matang, Manjung, Kinta, Kampar, Perak Tengah, Hilir Perak (northern part) and Batang Padang (northern part).

5. 2 Analysis on the city level

This analysis focusses on thirteen urban areas, which together account for a total population of 1,65 million, which equals around 63% of the total population in Perak (based on estimations for the year 2020). Ipoh, Taiping-Kamunting and Lumut-Sitiawan are by far the largest urban areas, which have a combined population of 1,125,800, which equals 68% of the total population in the urbanized part of the study area. The urban areas have been ranked according to their size, based on their population of 2016 (table 3). Comparing this rank-order with the former years, some things stand out. While the five largest urban areas remained their position during the years, the smaller towns changed in rank-position. The most interesting case is that of Seri Iskandar, which was the smallest town in 2000, while in 2010 and 2016 this town is ranked 9th. Looking at the average annual growth rates, the analysis indeed shows that Seri Iskandar has grown considerably, especially in the period 2000-2010, namely with an average annual growth rate of 6%, which can possibly be explained by a temporary student population, as will be discussed later. Furthermore, the three largest urban areas show lower growth rates in the 2010-2016 period compared to the former period. This is interesting since the five smallest urban areas show the opposite: higher population growth rates for the period 2010-2016.

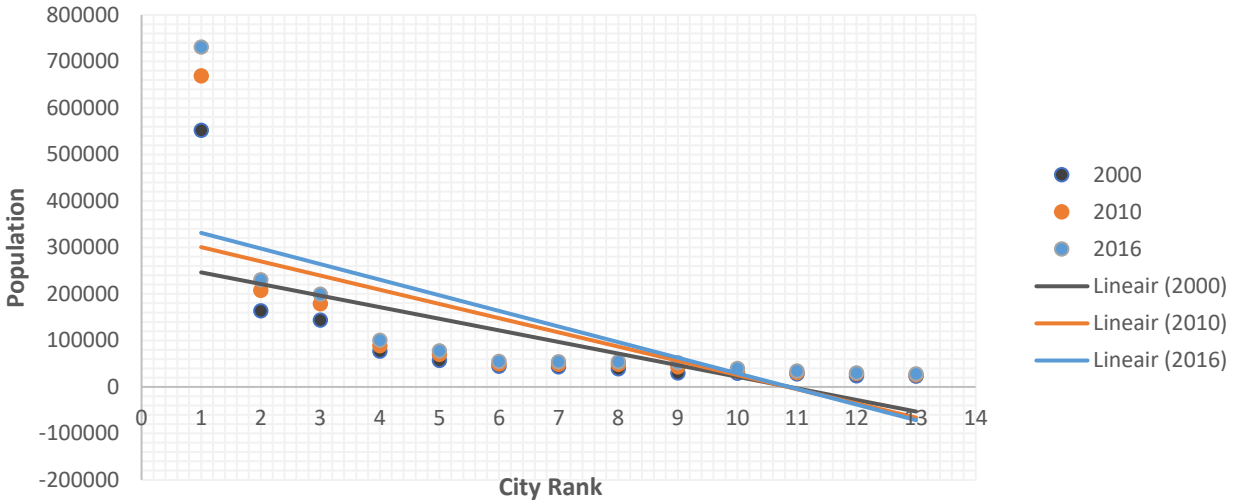
Table 3: Population distributions and growth rates per urban area. The urban areas are ordered from large to small, according to the population in 2016. *Source: Authors calculations, data obtained from DOSM (2019) and the report Data Asas Negeri Perak (2016).*

Urban area	**Total population per year***			**Average annual population growth rate (%)**	
	2000	**2010**	**2016**	**2000-2010**	**2010-2016**
Ipoh	552,121	669,218	730,900	1,92	1,47
Taiping-Kamunting	163,730	207,640	230,500	2,38	1,74
Lumut-Sitiawan	143,893	178,916	199,500	2,18	1,81
Teluk Intan	77,361	88,695	100,700	1,37	2,12
Kampar	57,389	69,940	77,700	1,98	1,75
Sungai Siput	43,385	48,954	54,700	1,21	1,85
Kuala Kangsar	44,773	49,226	54,600	0,95	1,73
Batu Gajah-Pusing	39,434	49,095	54,000	2,19	1,59
Seri Iskandar	23,468	43,062	52,600	6,07	3,33
Tapah	29,264	33,959	40,200	1,49	2,81
Bidor	30,389	31,244	34,700	0,28	1,75
Pantai Remis	28,045	28,832	30,400	0,28	0,88
Gopeng	23,998	26,363	28,400	0,94	1,24
Total	**1,257,250**	**1,525,144**	**1,688,900**	**1,93**	**1,70**

** Note that the total population of each urban area is based on the population of the corresponding mukim(s). Therefore, these population data might differ from population data on the municipality level, as discussed earlier.*

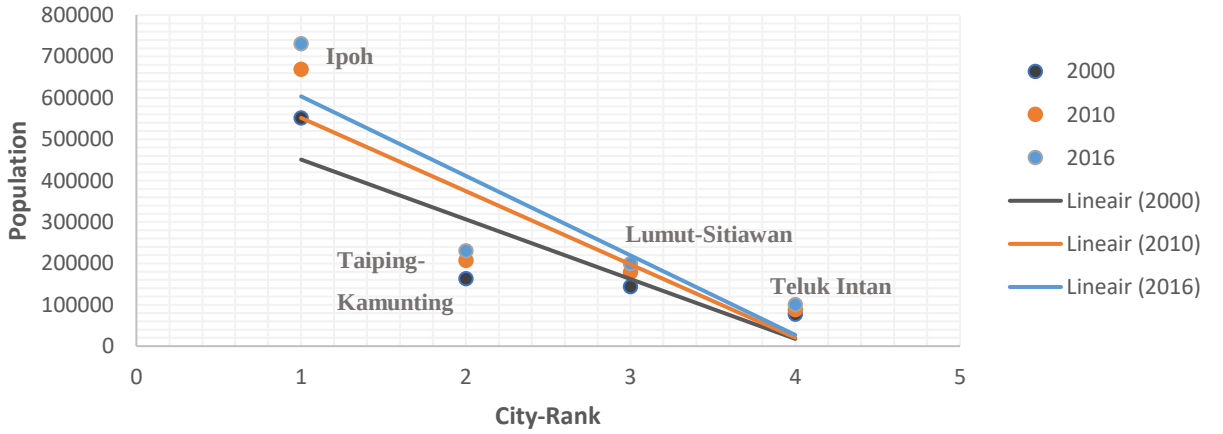
A polycentric urban region exists of multiple centres relatively equal in size. In terms of absolute population, Ipoh has a dominant position in the study area. The urban area of Taiping-Kamunting is about a third of Ipoh's size, similar to Lumut-Sitiawan. Rank-size distributions are calculated to identify whether the urban region of Perak shows characteristics of polycentric growth. Figure 13 shows the population distribution for the urban areas according to their rank, for the years 2000, 2010 and 2016. Following the line of reasoning of the literature, if an urban region shows characteristics of polycentric growth, linear-trend lines become less steep over time, indicating that the smaller cities in a region are gaining in size, compared to the larger cities. However, as shown by the graph, in the case of the 'Perak Diamond', linear trend lines actually become steeper, which is a characteristic of *monocentric* regional growth (figure 13).

Figure 13: rank-size distribution, based on the populations of the urban areas in the study area, for the years 2000, 2010 and 2016. *Source: authors calculations, based on data from DOSM (2019) and the report Data Asas Negeri Perak (2016).*



Taking into account only the four largest urban areas in the study area, the rank-size model shows a similar trend: the slope of the linear line become steeper (figure 14). This indicates that also in the scenario where the smaller cities have been excluded from the analysis, Ipoh's 'weight' in the regional urban system has been increasing over the years, which suggests the presence of a monocentric regional structure.

Figure 14: rank-size distribution, based on the populations of four largest urban centres in the study area, for the years 2000, 2010 and 2016. *Source: authors calculations, based on data from DOSM (2019) and the report Data Asas Negeri Perak (2016).*



6. Multi-temporal analysis of built-up area expansion

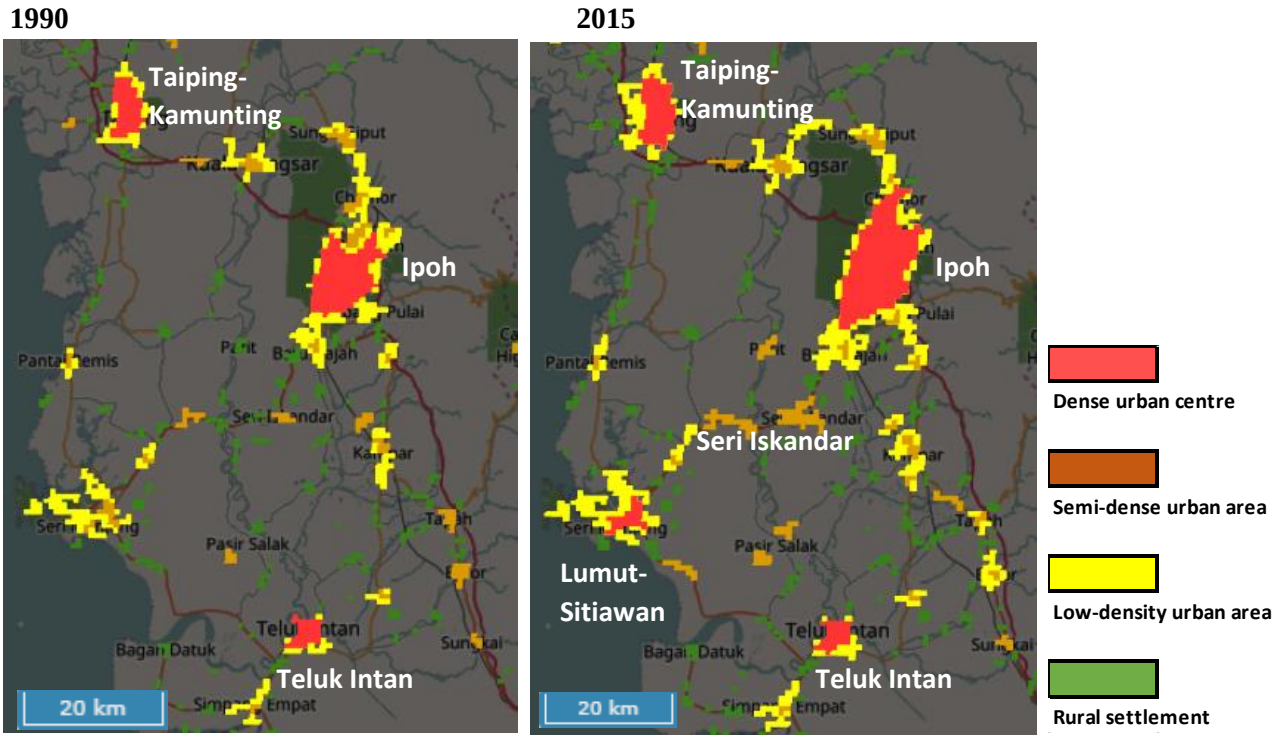
Aim of this chapter is to visualise historical land developments trends of urban areas in the study area in the period 1990-2015. The data sources used are the GHS-SMOD and the GHS-BUILT layer (see methodology). The GHS-SMOD layer allows for the detection of changes in population density for each urban area. For the outstanding cases, the GHS-BUILT layer is used for a more in-depth analysis of built-up area expansion of these urban areas over the years.

6.1 Classifying urban centres in the study area

For the visualisation of the density of each urban area, the GHS-SMOD layer (Pesaresi et al., 2019; European Commission, 2019) is used for the years 1990 and 2015. This layer shows the population distribution per grid cell and allows for the detection of urban centres in the study area (figure 15). In 1990, three urban centres can be identified, namely Ipoh, Taiping-Kamunting and Teluk Intan, characterized by a relatively high population density of more than 15 inhabitants per hectare grid cell. Interestingly, Lumut-Sitiawan is not classified as urban centre until 2015. Before this, most of the urban area of Lumut-Sitiawan is classified by semi-dense and suburban grid cells, which suggest that the built-up surface of Lumut-Sitiawan has developed in a less compact way compared to Ipoh, Taiping-Kamunting and Teluk Intan.

Comparing the situation of Ipoh in 1990 and 2015, it can be observed that in the northern part of the city, most suburban and semi-dense areas transformed into the urban centre classification. This suggests that from 1990 onwards, most built-up expansion in Ipoh will be characterized by infill developments in the northern part of the existing built-up area. Taiping-Kamunting shows an expansion of a low-density urban area in the west, suggesting that built-up expansion of this urban area is characterized by low-density developments towards this direction. Finally, it can be observed that Seri Iskandar transformed from mainly rural areas in 1990, towards a semi-dense area in 2015, suggesting a *corridor development pattern* alongside the road that connects Ipoh with Sitiawan.

Figure 15: Detection of urban centres in the study area in 1990 and 2015, based on definitions from the European Commission and the GHS-SMOD layer. *Source: Pesaresi et al. (2019) and Joint Research Centre of the EC (2019) (GHSL – SMOD dataset).*



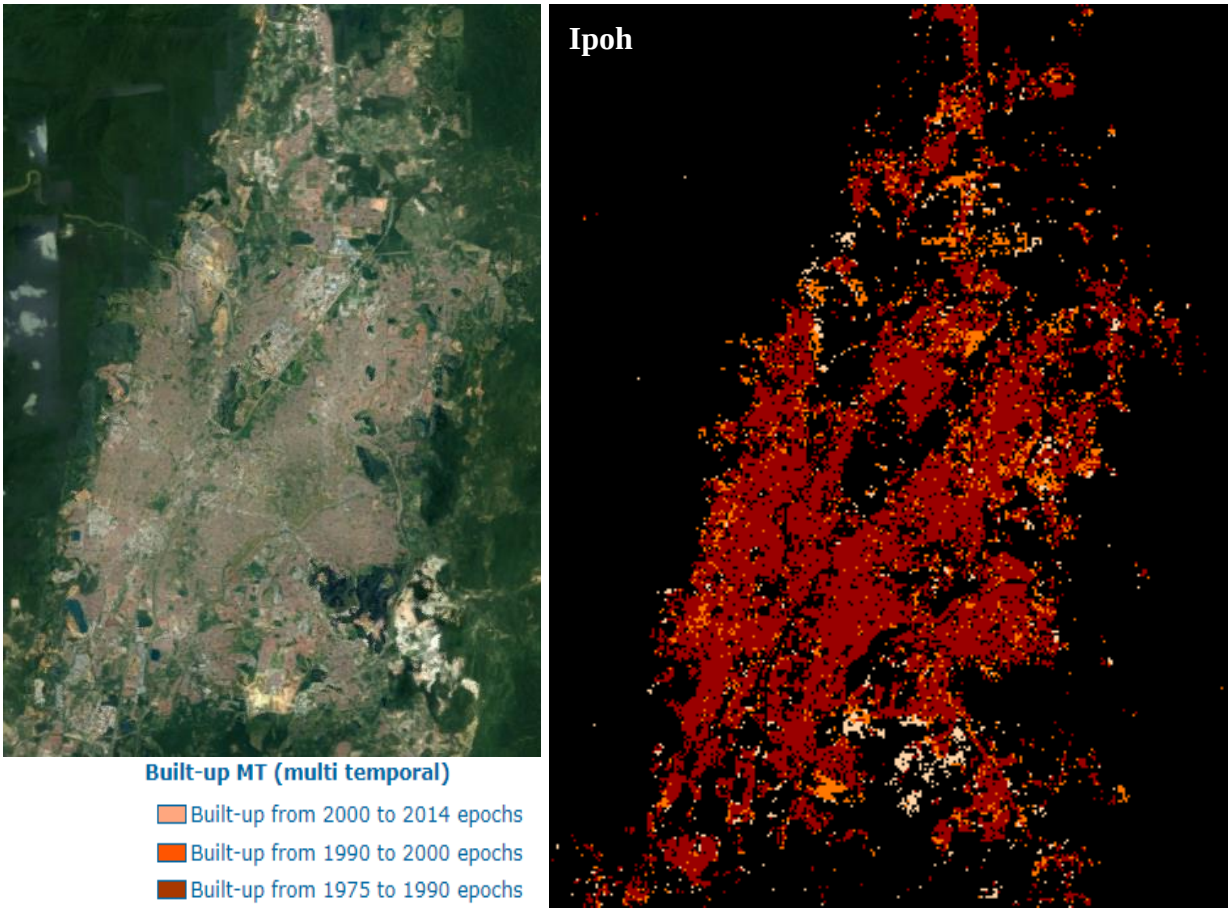
6.2 Built-up area expansion per urban area

This paragraph visualizes built-up area expansion for the urban centres in detail. Also, the situation in Seri Iskandar is discussed. Built-up area expansion maps for the other urban areas can be found in Appendix 5.

6.2.1 Ipoh

Ipoh is the largest urban area in the study area, with a total built-up area of 22,972 hectares in 2018[5]. Figure 16 visualizes the built-up area expansion in Ipoh from 1990 onwards. Built-up area expansion during the 1990-2000 period is mainly characterized by infill developments, spread out over the area, but shows high concentrations in the northern and north-eastern part of Ipoh. This indicates that the northern part of Ipoh is becoming more compact. This corresponds with the previous findings (figure 15), as this part of Ipoh was classified as urban centre in 2015. Urban extension patterns are mainly located in the north and south: this has to do with the fact that Ipoh is bordered with mountain terrain on the east and west. In the 2000-2014 period, a high concentration of built-up area presents itself in the southern part of Ipoh. This can be related to a large township development project (as will be discussed in detail in chapter 8). Furthermore, it can be observed that the southern part of Ipoh is relatively compact, compared to the north.

Figure 16: Multi-temporal information layer of built-up area expansion in Ipoh. *Source: Google Earth 2019 (left) and the European Commission 2019 (right), based on GHSL data © European Union, 1995-2019.*

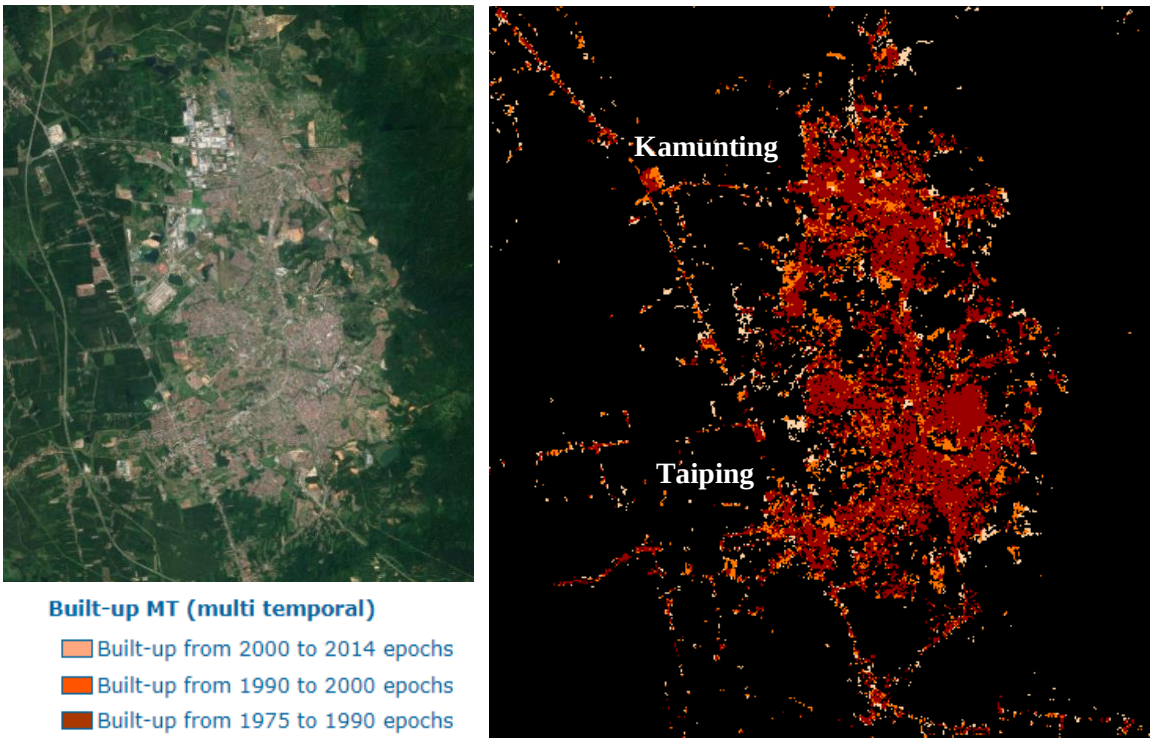


[5] Author's calculations, based on land-use data from JPBD 2018.

6.2.2 Taiping-Kamunting

Taiping-Kamunting has a total built-up area of 6264 hectares in 2018. Figure 17 visualizes the expansion of the built-up area of this urban agglomeration. Based on this, some observations stand out. Looking at the expansion of built-up areas during the 1990-2000 period, a rather dispersed development pattern can be observed, characterized by both infill developments as sprawled developments over the urban area.

Figure 17: Multi-temporal information layer of built-up area expansion in Taiping-Kamunting. *Source: Google Earth 2019 (left) and the European Commission 2019 (right), based on GHSL data © European Union, 1995-2019.*

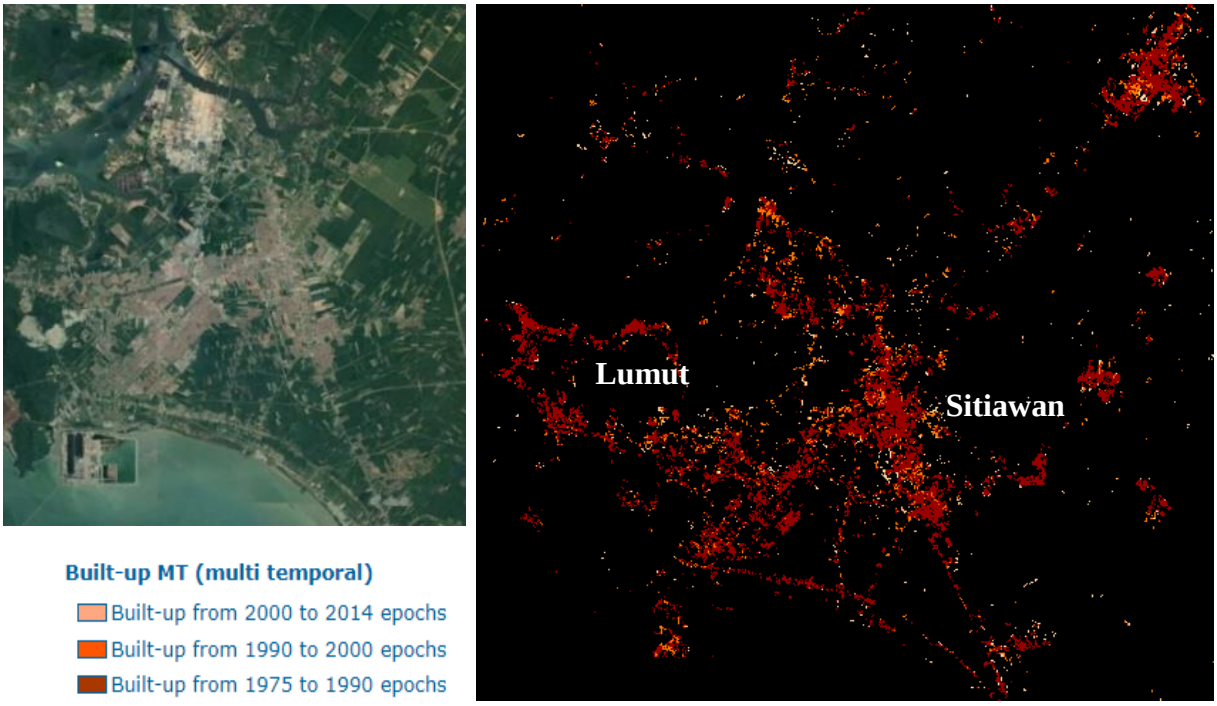


A large part of the built-up area expansion in this time period (1990-2000) took place within the existing urban area (infill developments). Another observation is that of urban expansion alongside the main road on the west. Developments alongside roads are a common pattern in Perak, as will discussed in chapter 8. Looking at the more recent built-up expansion, from 2000-2014, fewer infill developments can be observed. In fact, this period is more characterized by urban extension, on the borders of the existing urban area. Overall, the urban area is more expanding towards to west than to east, which has to do with the fact that the area borders a high terrain on the east. This observation explains the findings of paragraph 6.1, which showed low-density patterns on the west.

6.2.3 Lumut-Sitiawan

The urban area of Lumut-Sitiawan has a total built-up surface of 7,081 hectares in 2018. The built-up area of Lumut-Sitiawan is therefore somewhat larger compared to Taiping-Kamunting. However, as can be observed, the built-up area shows a rather dispersed pattern. In fact, sprawl phenomena can be observed during all time periods, characterized by developments alongside the roads and randomly spread out over the area. The expansion patterns support the findings of paragraph 6.1, in which the urban area is characterized by low-density and rural settlements This sprawled development pattern continues nowadays, as will be discussed later.

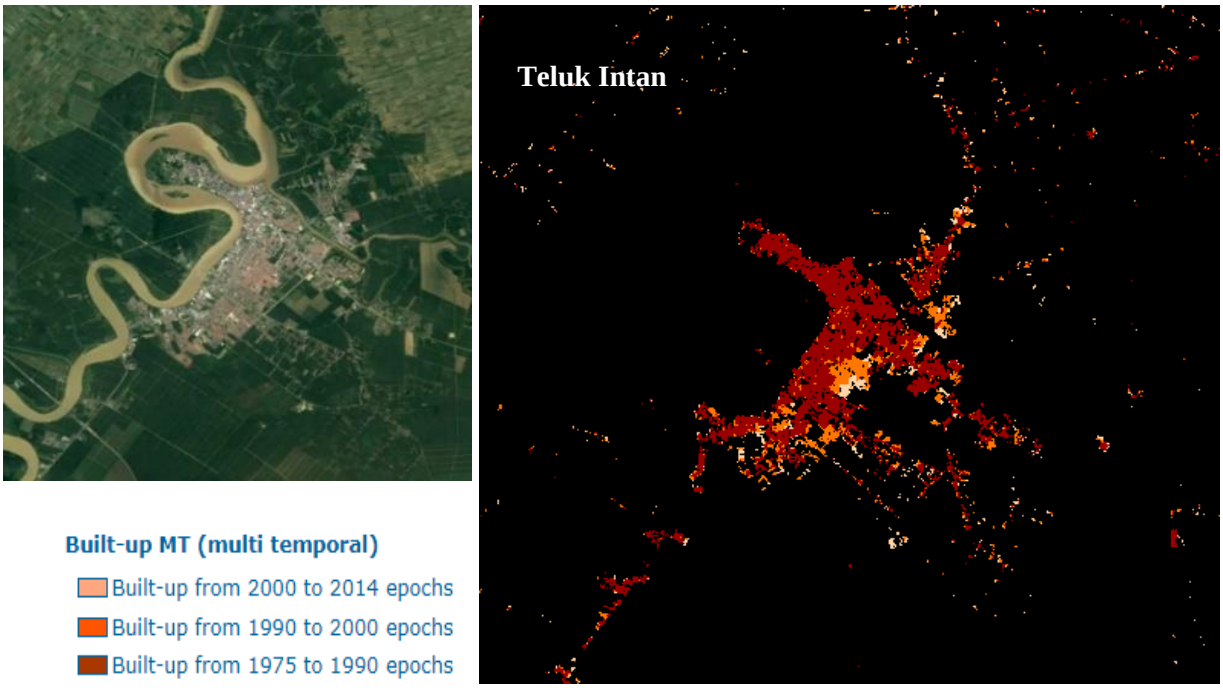
Figure 18: Multi-temporal information layer of built-up area expansion in Lumut-Sitiawan. *Source: Google Earth 2019 (left) and the European Commission 2019 (right), based on GHSL data © European Union, 1995-2019.*



6.2.4 Teluk Intan

Teluk Intan is located in the Hilir Perak district and has a total built-up surface of 4,461 hectares. Teluk Intan is the smallest of the urban centres in the study area in terms of land surface. On the west side, the area is bordered by the Perak river, which acts a natural barrier for further expansion. Indeed, looking at the built-up expansion, all developments were located on the east side of the city. The physical structure of the urban area is rather compact. In fact, urban sprawl phenomena are quite rare, and the expansion pattern is characterized by compact developments.

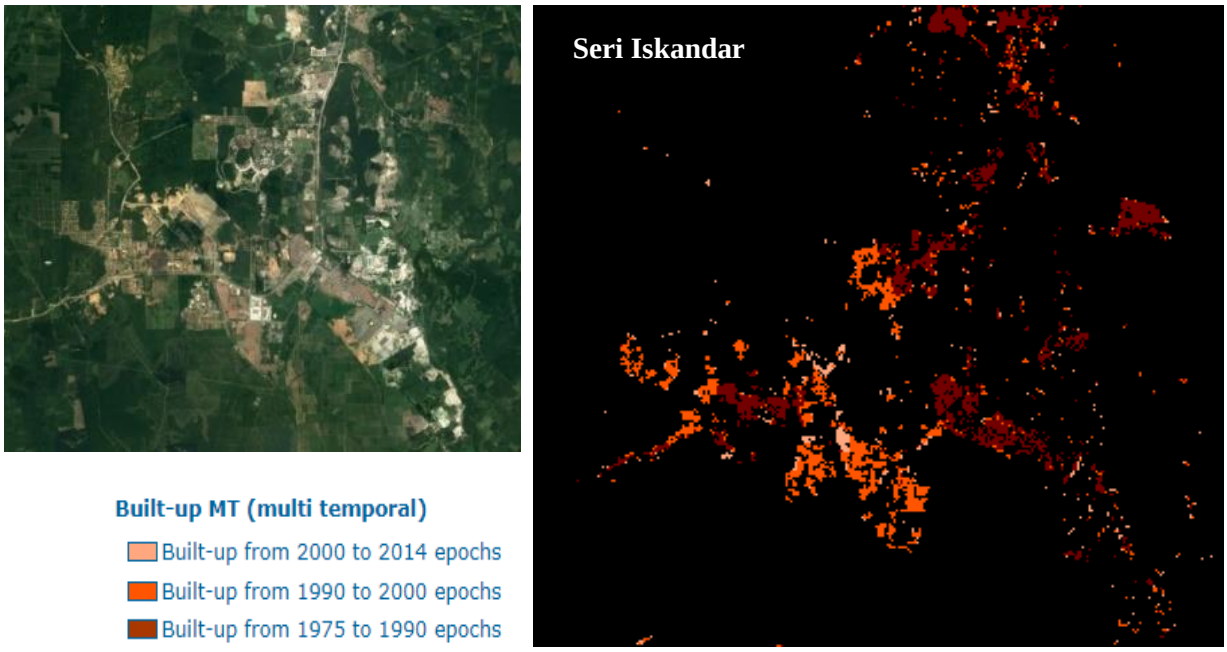
Figure 19: Multi-temporal information layer of built-up area expansion in Teluk Intan. *Source: Google Earth 2019 (left) and the European Commission 2019 (right), based on GHSL data © European Union, 1995-2019.*



6.2.5 Seri Iskandar

Seri Iskandar is centrally located in the study area, alongside the Ipoh-Lumut Highway, and has a total built-up area of about 2,322 hectares. Paragraph 6.1 showed that Seri Iskandar transformed from a mainly rural area in 1990 towards a semi-dense urban area in 2015. Indeed, considering built-up area expansion, it shows large concentrations in this urban area in the 1990-2000 period (figure 20). The relatively recent built-up expansion can be explained by the development of new universities and campuses, where Seri Iskandar is known for. This is also characterized by the land use statistics, as 39% of the built-up area in 2018 in this area is classified as 'institutional land use', which is relatively high compared to the land use statistics of the other urban areas (see for calculation appendix 7.1).

Figure 20: Multi-temporal information layer of built-up area expansion in Seri Iskandar. *Source: Google Earth 2019 (left) and the European Commission 2019 (right), based on GHSL data © European Union, 1995-2019.*



6.3 Population density per built-up area

For each urban centre, the exact population density has been calculated, defined as the number of people per hectare built-up area surface (see methodology). An overview of these land-use statistics and calculations can be found in appendix 7. The results of this analysis have been used to describe the efficiency of building patterns, as a higher population density suggest a more compact built-up form and generates more urban mass.

The population density is the highest in Teluk Intan, with an average of 39 persons per hectare built-up surface (table 4). The average population density in Taiping-Kamunting is comparable, namely 37 persons per hectare built-up surface. The population density in Ipoh is somewhat lower. The lowest population density is found in Lumut-Sitiawan, with 28 persons per hectare built-up surface. The difference in density between Lumut-Sitiawan and Teluk Intan might be explained by the fact that a relatively large share of the land-use in Lumut-Sitiawan is related to *industry, infrastructure and institutions*, namely 45% of the total urban land use, compared to 16% in Teluk Intan.

A benchmarked is made with the most developed urban areas of Malaysia. One is northeast Penang (Timur Laut district), with Georgetown as central city. The other urban area is the central part of Kuala Lumpur, also known as Bandaraya Kuala Lumpur. The administrative boundaries of these two urban areas can be found in appendix 7.2. The average population density per built-up surface in Northeast Penang is almost three times that of Ipoh, namely 95 persons per hectare built-up surface. For the central part of Kuala Lumpur this is somewhat lower, which might be explained by the fact that lots of commercial buildings are located in this part of Kuala Lumpur. Still, also in central Kuala Lumpur the average population density is much higher compared to the urban centres in the study area.

Table 4: Population density per built-up surface of the four largest cities in the study area and of Northeast Penang and Central K.L. *Source: authors calculations, based on land-use data of JPBD (2018), DOSM (2019) and Data Asas Negeri Perak (2016).*

Urban area	**Built-up surface (in hectares)**	**Population**	**Population density (pop/hect built-up)**
Ipoh	22,972	730,900	32
Taiping-Kamunting	6,264	230,500	37
Lumut-Sitiawan	7,081	199,500	28
Teluk Intan	2,605	100,700	39
Northeast Penang	5,482	520,242	95
Central Kuala Lumpur	20,685	1,674,000	81

Looking at the skylines of Ipoh and Northeast Penang, it can be observed that northeast Penang is characterized by much more high-rise developments, which explains the higher population density per hectare built-up area.

Figure 21: Panoramic views of the skylines of Ipoh (left) and northeast Penang (right). *Source: authors illustrations and TripAdvisor (2019).*

The findings of this chapter showed that urban sprawl is not necessarily a common pattern in Perak, as the built-up patterns of some urban areas expanded in a relatively compact manner. Considering the population density per built-up surface, it shows little variation between the urban areas in Perak, but a large difference with the more densely populated urban regions in Malaysia. This relates to a common pattern of low-density landed housing developments, as will be discussed in chapter 9.

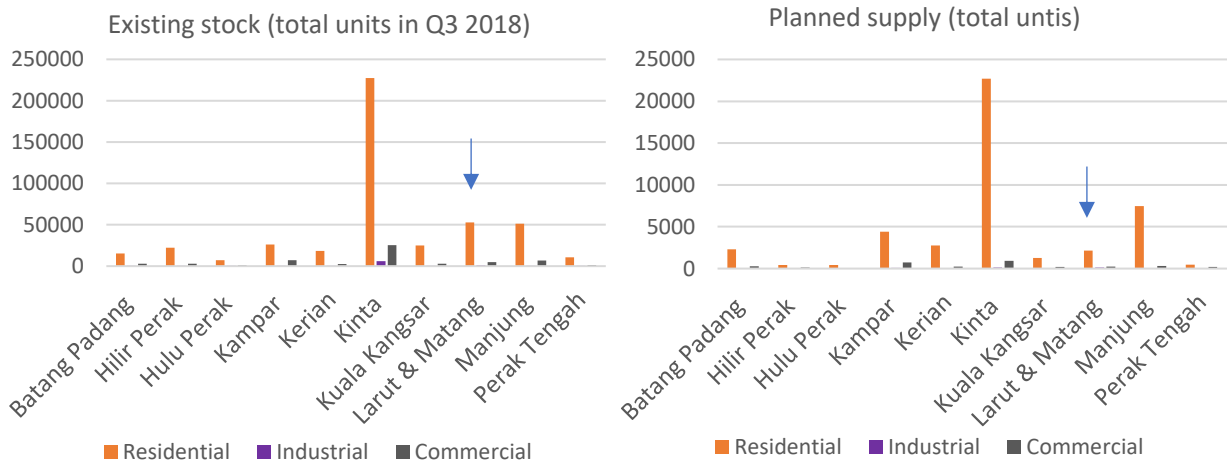
7. Spatial patterns of recent building construction

This chapter provides an overview of the distribution of recent construction projects through the study area, which is used as an indicator to forecast towards what direction the centrality of the regional urban structure is evolving. The chapter starts with an overall description of the property stock in Perak on a district level. Next, the chapter zooms in to a lower scale level, by analysing the spatial distribution of applications for developments per urban area over the period 2013-2017. Finally, current construction locations (observed during field trips) have been mapped to show the impact on the existing built-up area.

7.1 Distribution of the property stock per district

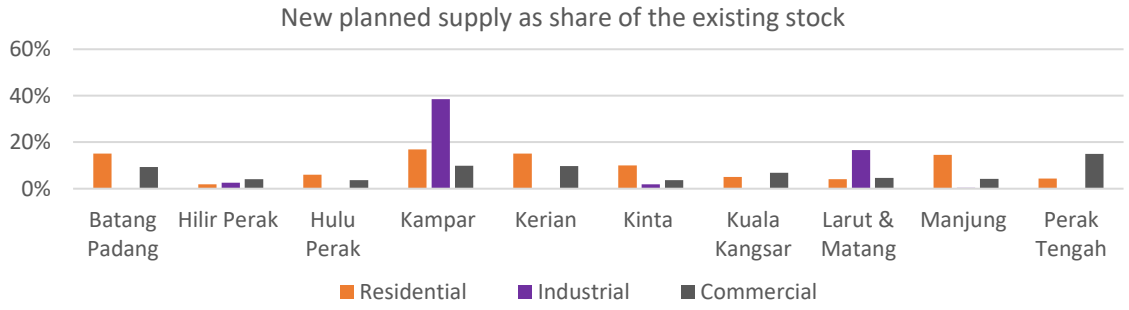
The total property stock in Perak in Q3 of 2018 exists of 523.261 units, of which 87% are residential units (NAPIC, 2019). Taking into account the spatial distribution of the residential property stock on the district level (figure 22) it can be observed that the Kinta district accounts for the largest share, namely 50% of the total residential stock Perak (227.500 units). This can be explained by the presence of Ipoh in this district. The *existing residential property stock* in Larut & Matang and Manjung is almost equal. Interestingly, looking at the planned supply of residential units (figure 22), it can be observed that the *planned supply* of residential units in the Larut & Matang district (2167 units) is relatively small compared to the Manjung district (7474 units). This corresponds with the trends in recent construction activity in these districts, as will be discussed later.

Figure 22: Spatial distribution of the existing property stock and planned supply in Perak, sorted by district and type. *Source: authors calculations, data obtained from NAPIC (2019).*



Interestingly, considering the new planned supply, it can be observed that in Kampar and Larut & Matang, the industrial property stock is expected to grow relatively fast (figure 23). In fact, Kampar plans to add 722 units to their industrial property stock, which suggests that the existing industrial stock will increase with 39% in the coming years.

Figure 23: Relative growth of each property type per district. *Source: authors calculations, based on data from NAPIC (2019).*



7.2 Analysis of applications for developments (APDL's)

The construction sector in Malaysia operates under control of (local) governments. Therefore, approval is necessary for different phases of the development process. Before a developer is allowed to start with the construction phase, he needs approval in the form of a permit. These permits are called 'applications for development' and are classified in different categories.

Types of applications for development
-Application for change of land-use
-Application for change of express condition
-Application for subdivision of land
-Application for planning approval/development order
-Application for building plan approval
-Application for advertisement and sale permit
-Application for the commencement of works

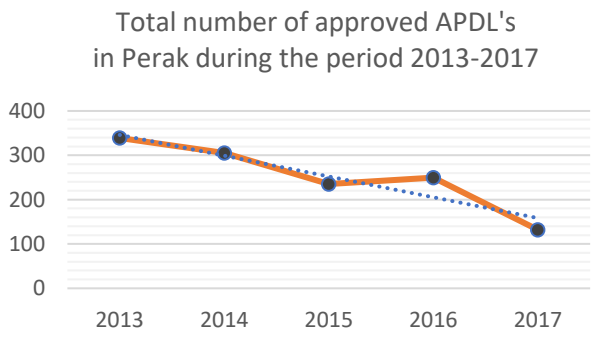
For example, if a developer plans to build a housing project on a parcel of land defined as 'agriculture land', the developer needs to start with changing the land use category from agriculture into residential. For this, the developer needs to fill in an application for change of land-use, which need to be approved by the local government.

This paragraph analyses the spatial distribution of APDL's within Perak, for the years 2013-2017, obtained from LPHP. APDL stands for Advertisement Permit and Developer's Licence: it an approval acquired from the local housing ministry to advertise and commence the selling of products. Developers need this type of permit *when they sell more than 70% of the units of a project in advance.*

There are two reasons why a developer would choose this option. First, selling units in advance offers assurance that the project will be profitable; second, the developer creates a cash flow which can be used to pay for construction costs. According to Mr Sabri, deputy CEO of the Perak Housing and Property Board (LPHP), most developers in Perak, and Malaysia in general, operate this way. Especially under the previous government it was difficult to get bank loans for construction projects, which stimulated the necessity to choose for this option. Only developers with a sufficient amount of financial capital might start construction before selling in advance.

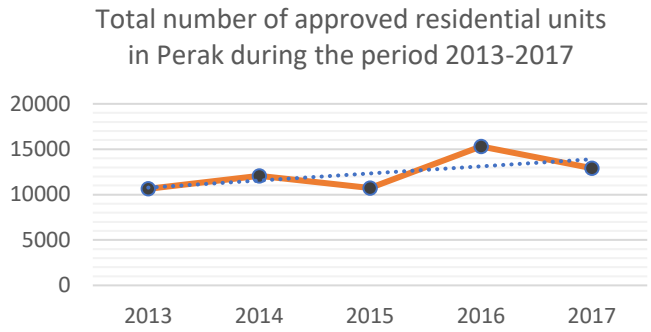
As most developers need an approved APDL, this type of application is a useful indicator of where building construction is located. Mr Sabri explains that this type of application is more accurate than *building plan approvals:* after a building plan approval is granted, developers might decide to wait with the construction phase until the construction is in his favour, for example when steel prices go down. Therefore, APDL's are considered as the most relevant for this research.

Figure 24: Graph that shows a trend of approved APDLS's in Perak. *Source: authors calculations, data obtained from LPHP.*



The data obtained from the LPHP exists in total of 1264 approved APDL's. These are all the APDL's that have been approved in Perak during the years 2013-2017. *(Note that the analysis of the APDL's only relates to housing developments*). During this period, the total number of approved APDL's has been decreasing over the years, from 339 permits in 2013 to 132 permits in 2017 (figure 24).

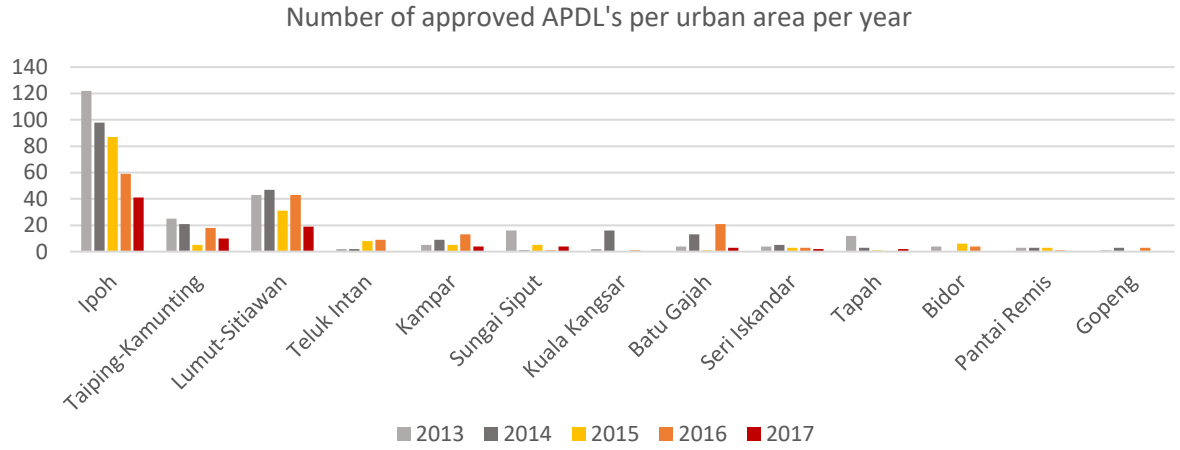
Figure 25: Graph that shows the increase of approved residential units. *Source: authors calculations, data obtained from LPHP.*



The total number of units approved in the 2013-2017 period is 61,658. Interestingly, considering the approved number of units per project, the trend shows the opposite: the total number of units approved in 2013 was 10,640, while in 2017 this was 12,920 (figure 25). This suggests that the average size of housing projects, measured in the number of units, is slightly rising.

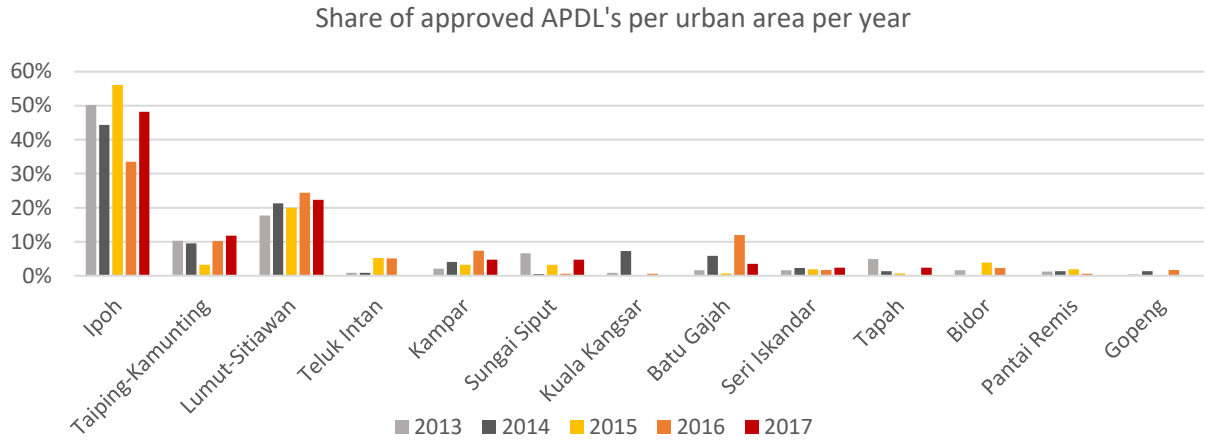
Considering the spatial distribution of approved APDL's over the urban areas (figure 26), it becomes clear that most approved APDL's are found in Ipoh, which suggests a high concentration of construction projects in this area. However, in Ipoh, the number of approved APDL's declined over the years, which suggest that the number of construction projects in Ipoh is decreasing. Furthermore, the graph shows a relatively high number of approved APDL's in Lumut-Sitiawan, almost double the numbers of Taiping-Kamunting. Taiping-Kamunting also shows a decrease, with the exception of a one-year increase in 2016. Teluk Íntan shows a slight increase. However, the total number of approved APDL's is relatively small, comparable with the other smaller urban areas. This suggests that in the 2013-2017, the highest concentrations of building construction projects were located in the two largest urban areas.

Figure 26: Bar chart that shows the spatial distribution and growth of approved APDL's per urban area. *Source: authors calculations, data obtained from LPHP.*



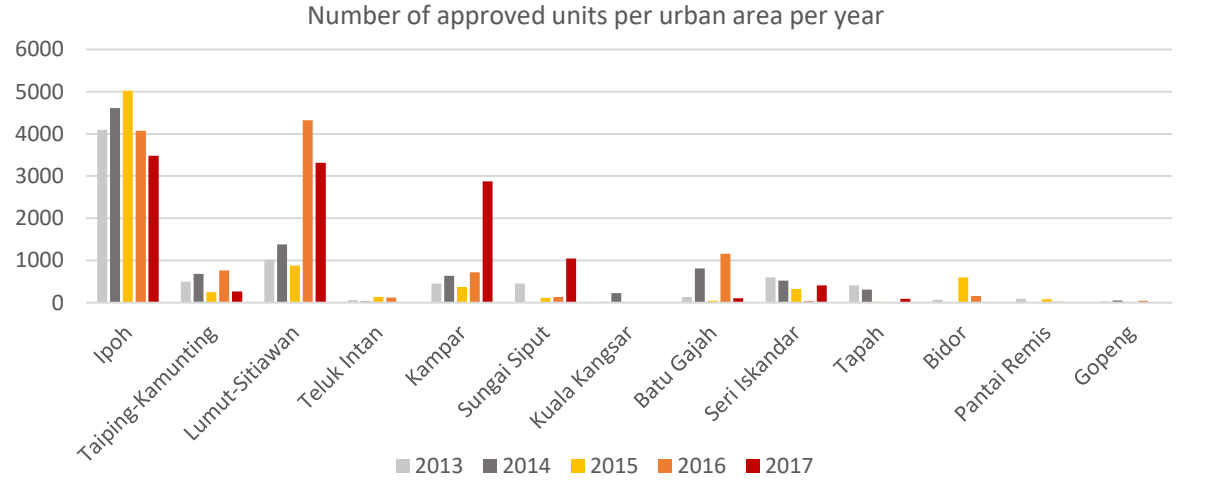
Looking at the share (of the total) of the approved APDL's per urban area (figure 27), it becomes clear that besides Ipoh, which still holds a dominant position, the share of APDL's in Lumut-Sitiawan is relatively large and increasing. This suggests that Lumut-Sitiawan is becoming more popular among developer as location for construction projects. The share of APDL's in other urban areas is low. Teluk Intan the share is increasing, which suggest that in these urban areas, relatively high concentrations of construction projects can be expected. Of the smaller towns, Seri Iskandar's share is relatively stable over the years, which indicates that this urban area remained of equal importance.

Figure 27: Bar chart that shows the relative growth of approved APDL's per urban area. *Source: authors calculations, data obtained from LPHP.*



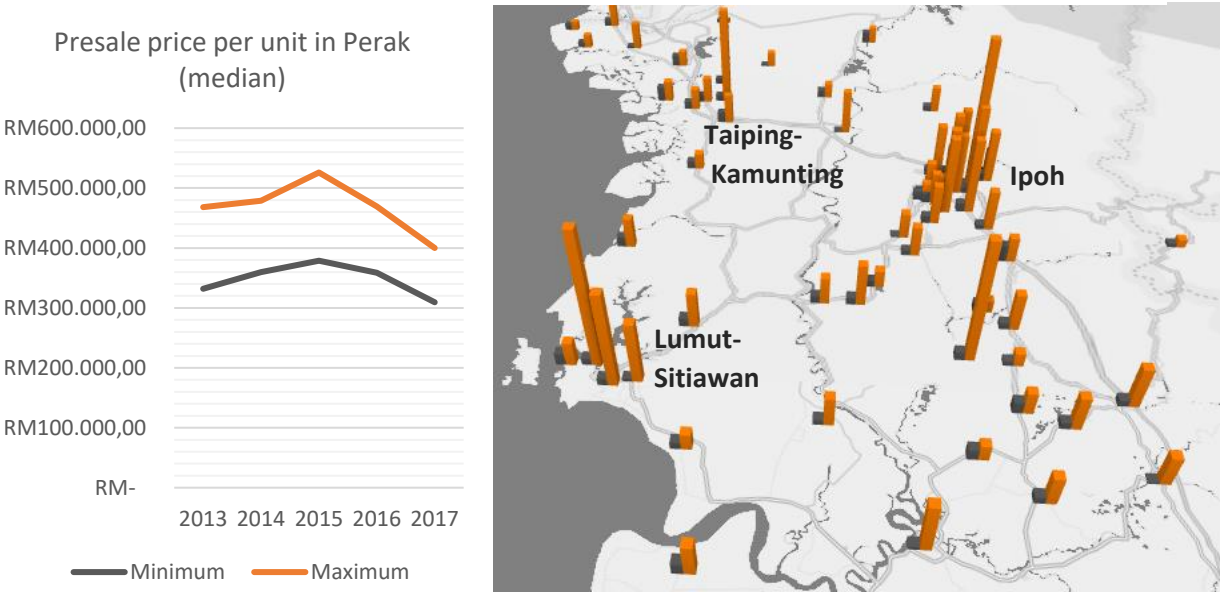
As the APDLs' do not inform about the land consumption (size of the land used per project), the size of a project has been measured as the total number of units built. Interestingly, in the years 2016 and 2017, a relatively high number of units have been approved in Lumut-Sitiawan. In fact, in 2016 the number of units approved in this area is higher than in Ipoh. A closer inspection in the database shows that these high numbers are the results of two approvals for (phases of) housing projects: Bandar Baru Setia Awan (1147 units) and PR1MA at Sitiawan (1268 units), which are both affordable housing programmes. These affordable housing schemes make a considerable impact in the study area, as will be discussed in chapter 9.

Figure 28: Bar chart that shows the growth of approved residential units per urban area. *Source: authors calculations, data obtained from LPHP.*



Considering the spatial distribution of the total number of approved units over the years, the highest concentrations of building construction can be expected to take place around Ipoh and Lumut-Sitiawan. The findings also suggest less construction in the urban areas of Taiping-Kamunting and Teluk Intan. Interestingly, the number of units approved in the 2013-2017 period in Seri Iskandar is similar to Taiping-Kamunting. This is unexpected, as Seri Iskandar is a relatively small area. However, it matches the findings of the historic built-up area expansion patterns, as this trend seems to continue. The growth potential of Seri Iskandar will be discussed in more detail in chapter 8.

Figure 29: Median of minimum and maximum presale prices per residential unit in Perak in 2013-2017 (left) and the spatial differentiation per urban area, based on postal codes. *Source: authors calculations and visualisation, based on data of LPHP. Base-layer for visualisation: Bing Maps (2019).*



For an analysis of housing prices in the study area, the minimum and maximum unit presale price per project are used as indicator. The median is calculated per year and per urban area. The median is used as indicator, as average selling prices might be affected by outliers. Prices for housing units in Perak increased until 2015, after which they started to decline. In 2015, median selling prices vary between RM378,800 and RM526,000 per unit. In 2017, the selling prices decreased to RM309,440 and RM400,000 respectively. The spatial distribution of the median selling prices shows that most variations can be found in the urban areas of Lumut-Sitiawan and Ipoh. This corresponds with the fact that these areas account for most of the approved units in 2013-2017 (figure 30). This suggests a high demand for housing in this area, which could explain the higher selling prices in Ipoh and Taiping-Kamunting.

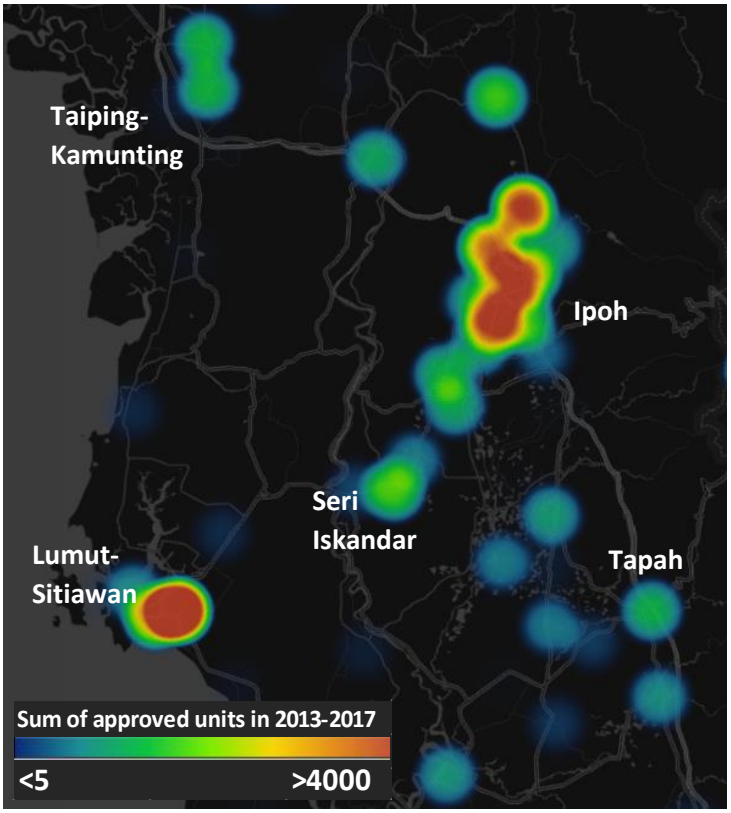


Figure 30: Heatmap that shows the spatial distribution of approved residential units according to APDL's in the period 2013-2017.

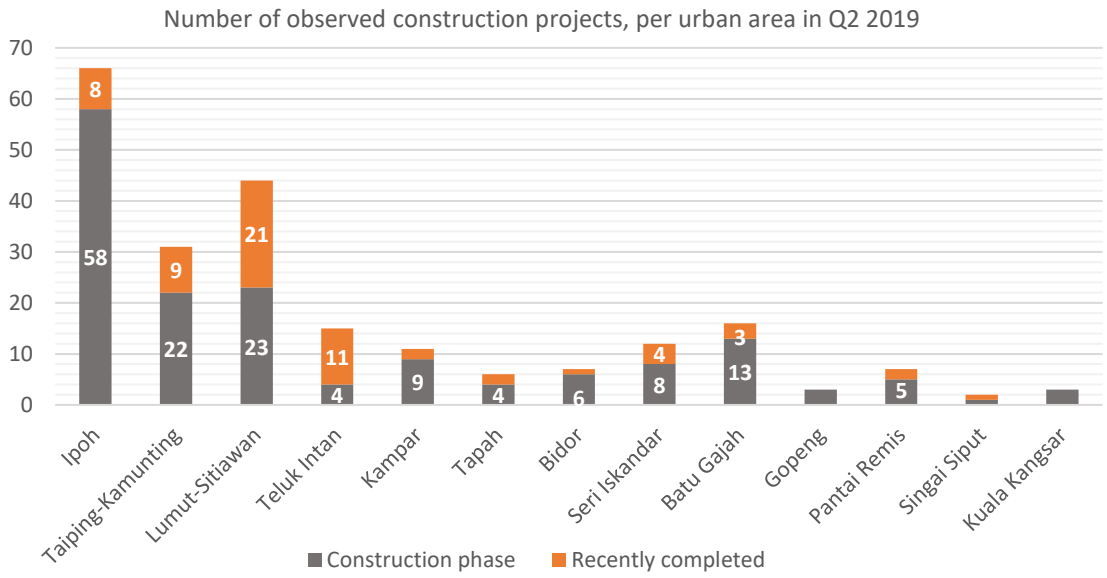
Source: authors calculations and visualisations, data obtained from LPHP. Base-layer for visualisation: Bing Maps (2019).

7.3 Spatial patterns of building construction in 2019

Note: The data provided in this paragraph are based on fieldwork observations, in some cases supported by additional information obtained from real estate developers. Smaller construction projects, such as housing projects of less than 10 units, were ignored during the field trips. The focus is on larger development projects, characterized either by a relatively high number of units, or which consume relatively large land plots. The chapter aims to unravel spatial differences in current building construction in the study area.

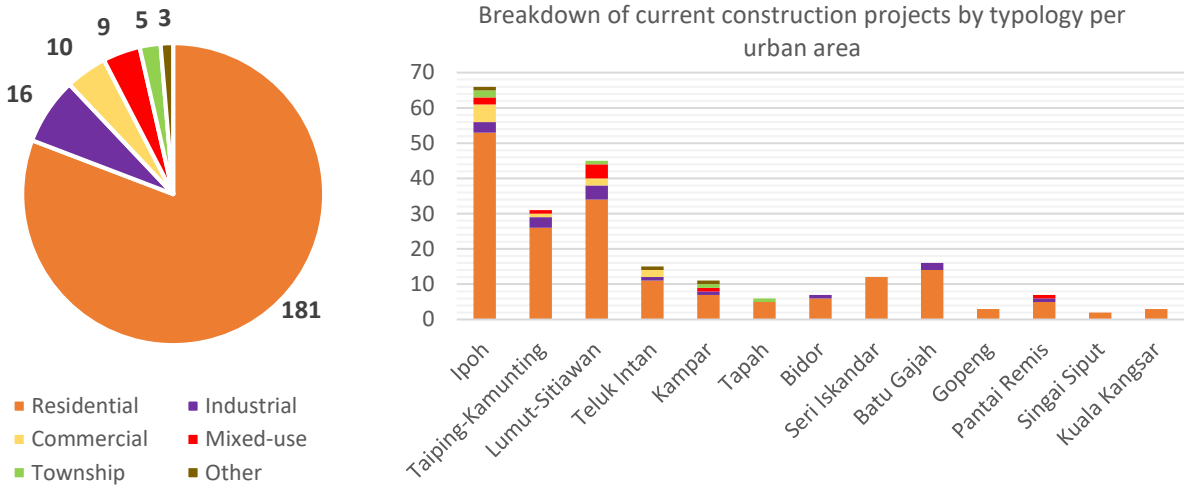
Within the case study area, a total of 224 construction projects have been observed during the second quarter (April-June) of 2019. Of these, 159 projects are currently under construction, and 64 projects have been recently completed, but are not occupied yet. As expected, most of the projects are located in Ipoh, a total of 66, most of which currently in the construction phase. The urban area of Lumut-Sitiawan also shows a relatively large number of construction projects, namely 44, of which almost half have been recently completed. The urban area Taiping-Kamunting also shows a relatively large concentration of construction projects, compared to the other cities.

Figure 31: Bar chart that shows the number of observed construction projects per urban area. *Source: authors calculations, based on observations (2019)*



A distinction is made between different types of construction projects, which are; *residential; industrial; commercial; mixed-use; township development; and 'other'*. Breaking down the total number of observed construction projects by typology, it can be observed that residential projects are by far the most present in the study area; 181 of the 224 projects are residential, about 81% of the total number of observed projects (figure 32). Besides these residential developments, 16 industrial, 10 commercial and 9 mixed-use projects have been observed. Further, the category 'other' exists of three projects, namely two schools and a hospital. The other five developments that are identified are characterized as townships, which together have a large impact on the region, as will be discussed later.

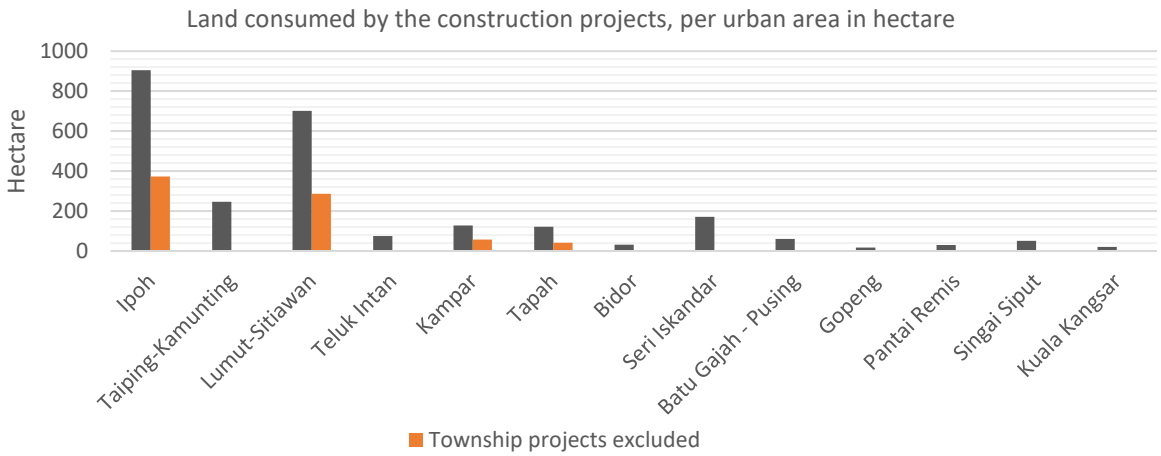
Figure 32: *breakdown of the observed construction projects in typology; total numbers (circle diagram) and per urban area (bar chart). Source: authors calculations and observations (2019).*



Considering how different types of construction projects are divided over the urban areas, some things stand out (figure 32). Residential projects are present in all urban areas. In Seri Iskandar, Gopeng, Singai Siput and Kuala Kangsar, all the projects are residential developments. The industrial projects are mainly located in Taiping-Kamunting (3), Lumut-Sitiawan (4), Batu Gajah (2) and Ipoh (3). Most of the mixed-use developments are located in Lumut-Sitiawan (4), while most commercial developments are located in Ipoh (5). In both Ipoh and Teluk Intan, a school building is being developed. In Kampar, the development categorised as 'other' is a hospital. The township developments are large development projects that are suspected to have a considerable impact on the region. These township developments are located in Ipoh (2), Manjung (1), Tapah (1) and Kampar (1).

Figure 33 shows the size of the construction projects per urban area, measured in hectares. In other words, it shows how much land is consumed by the new developments, which directly affects land use patterns in the urban areas. This information is essential to forecast the effects of land development on the existing built-up density in the different urban areas. Again, it becomes clear that township developments have a considerable impact, considering the land that is used for these developments.

Figure 33: land consumption by construction projects per urban area, measured in hectares. The orange bars show the scenario where township projects are excluded from the analysis. *Source: authors calculations and observations (2019).*



The spatial distribution of the observed construction projects is visualized (figure 34). The colour of the circles represents the type of development, while the size of the circle represents the relative size of each project, measured by the land consumption in hectares. (*A detailed overview of the characteristics per project can be found in appendix 6).*

It can be observed that most of the observed construction projects are located within or in close distance to the urban areas. Exceptions are two notable inter-urban developments are located between Lumut-Sitiawan and Teluk Intan. These are the township project Bandar Setia Awan, developed by Setia Awan Holdings Sdn. Bhd.; and Taman Felcra Jaya (orange circle left of Teluk Intan), developed by Felcra Berhad. Interviews with the developers of these two projects have been carried out to understand the drivers and site-selection decisions behind these inter-urban developments and will be discussed in chapter 8.3. Furthermore, a relatively large industrial development is located in the Lumut area, which can be related to the industrial characteristics of this location as mentioned earlier. Teluk Intan shows very little construction activity. Township developments account for most of the land consumption, as presented by the relatively large size of the green circles. The large township project south of Ipoh, 'Bandar Seri Botani', is an extension of the existing built-up land and consumes 507 hectares of land in total. Another large township project, Bandar Setia Awan, is an inter-urban development located close to the urban area of Lumut-Sitiawan. This project consumes 414 hectares of land in total. The other three township developments are located in Tapah, Kampar and the northern part of Ipoh.

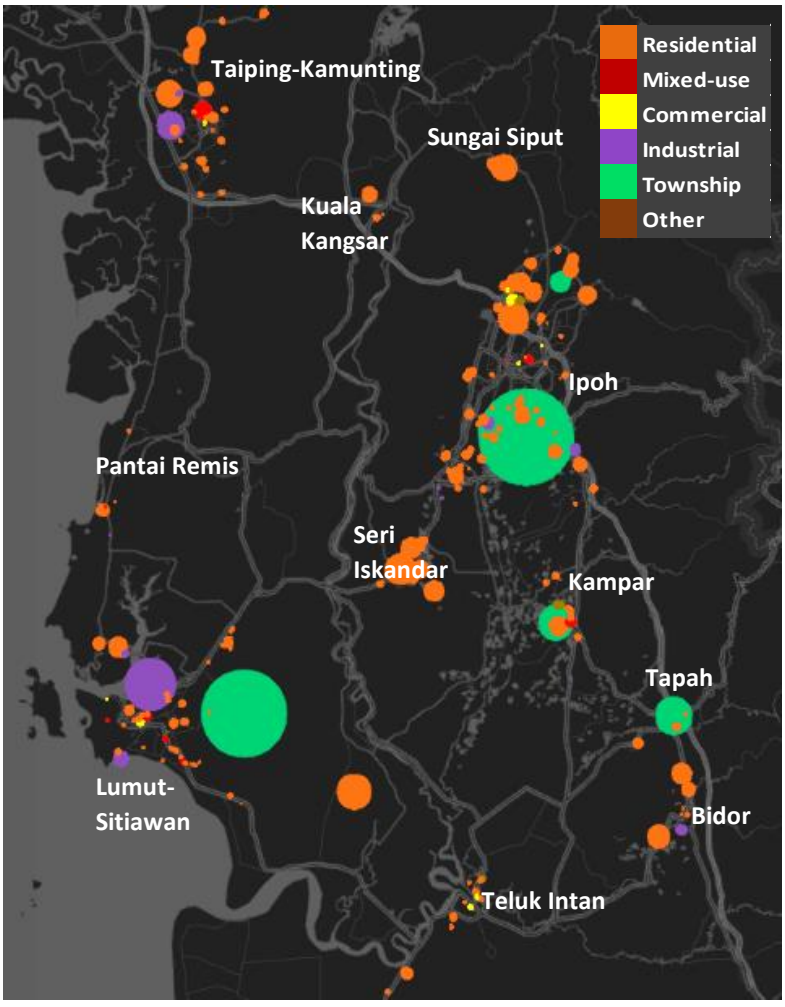


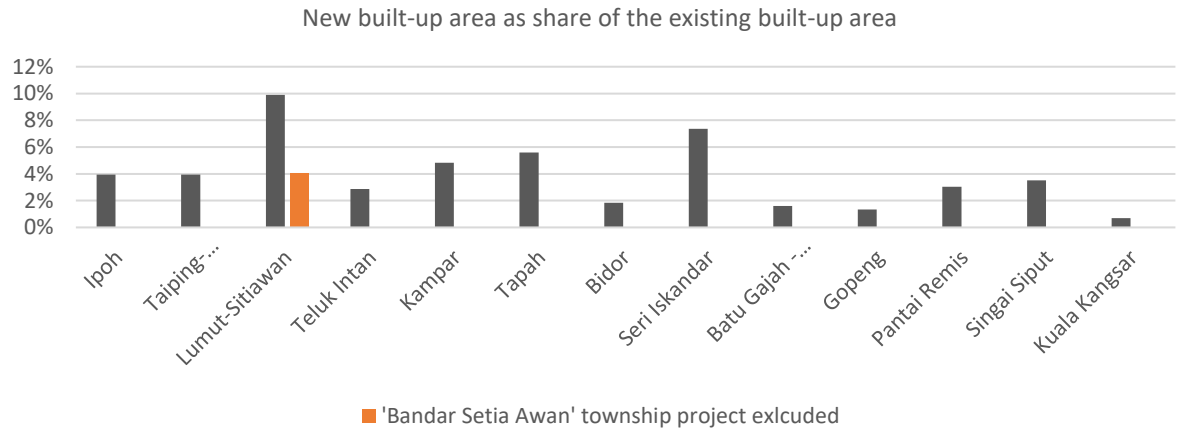
Figure 34: Spatial distribution of the observed construction projects in the period April-June 2019, per type and size. The size of the circle is a relative presentation of the land consumption of each project.

Source: authors calculations and visualisation. Base-layer: BingMaps (2019).

7.3.1 Impact of the observed projects on existing built-up areas

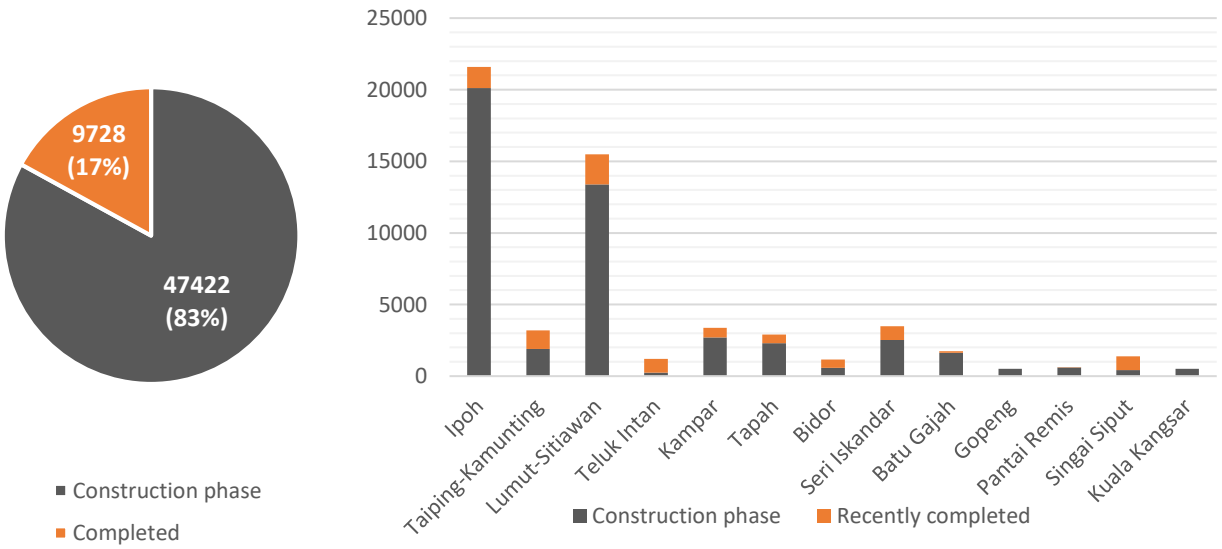
To understand how new developments impact existing urban form, the expansion of the built-up areas is compared with the existing built-up areas (figure 35). As shown in the graph, in Lumut-Sitiawan, the expansion of the built-up area is relatively the highest. This is mainly due to the Bandar Sitia Awan township project, which almost accounts for 6% to the total built-up area expansion in this area. However, as this township project is located 15km east of the Lumut-Sitiawan, it should not be considered as actual extension of the built-up area in Lumut-Sitiawan. Looking at the scenario whereby the township project is excluded from the analysis, it can be observed that in Seri Iskandar, the built-up area expansion is relatively the highest.

Figure 35: Relative growth of built-up areas per urban area. *Source: authors calculations and observations (2019).*



Together, all the observed construction projects add an estimated 56,566 units to the property stock in the study area. Of these, 53,971 units are defined as residential units, which equals 95% (including township projects). Of these, 47,422 units (83%) are currently under construction, while 9,728 units (17%) have been completed recently. Most of the completed units are still vacant, left a few exceptions. The completed units can be considered as not yet occupied.

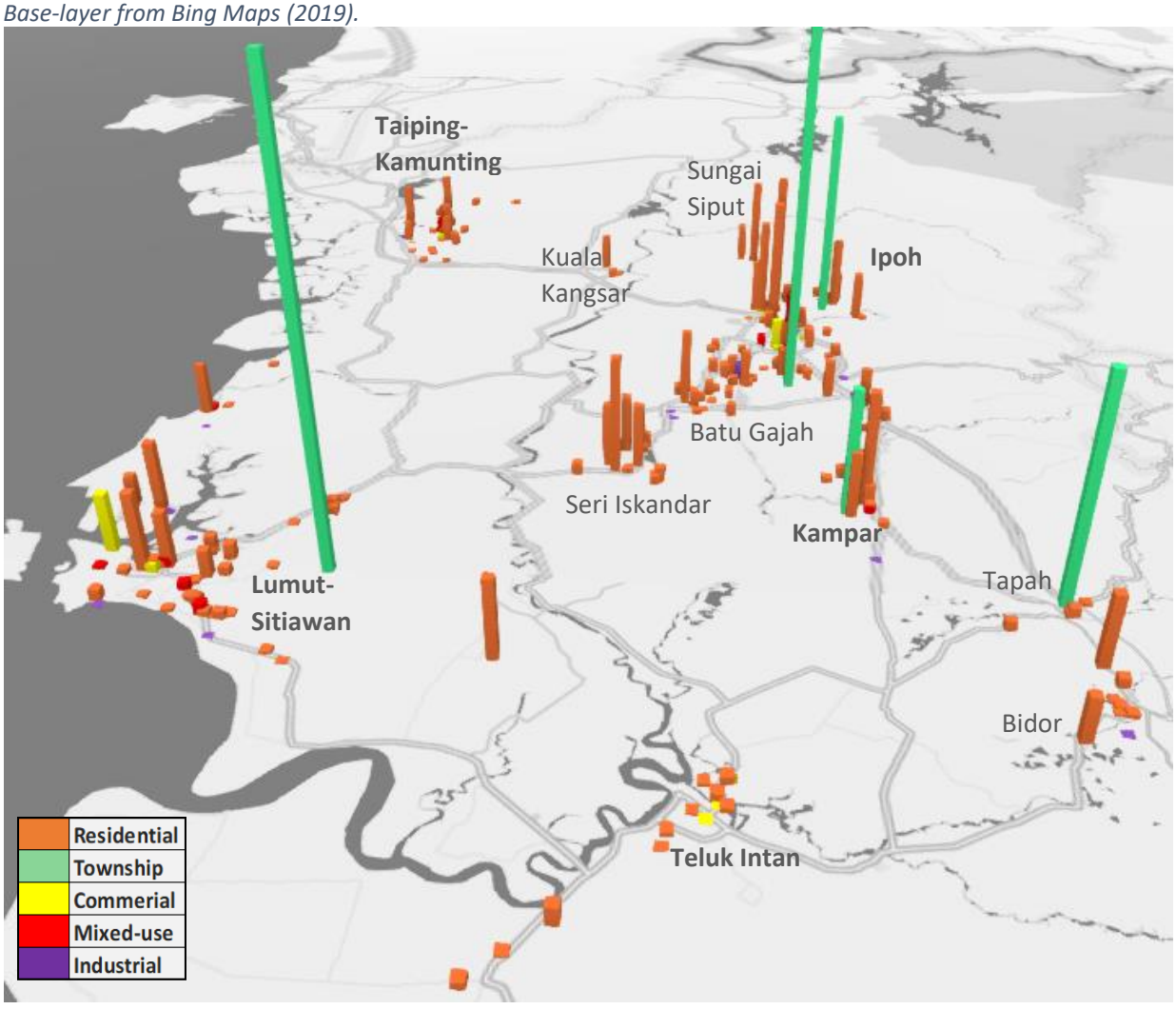
Figure 36 number of units added to the property stock (based on the observed projects in Q2 2019). In total (circle diagram) and per urban area (bar chart). *Source: authors calculations and observations (2019).*



As expected, most units added to the stock are located in Ipoh, a total of 21,587 units, which equals 38%. Notable is that the urban area of Lumut-Sitiawan accounts for another large share of new units added to the stock, namely 15,488 units, which equals 27%. In the urban agglomeration Taiping-Kamunting, on the other hand, a relatively small number of units is being added to the stock, namely 3,185 units, which equals 6% of the total number of units.

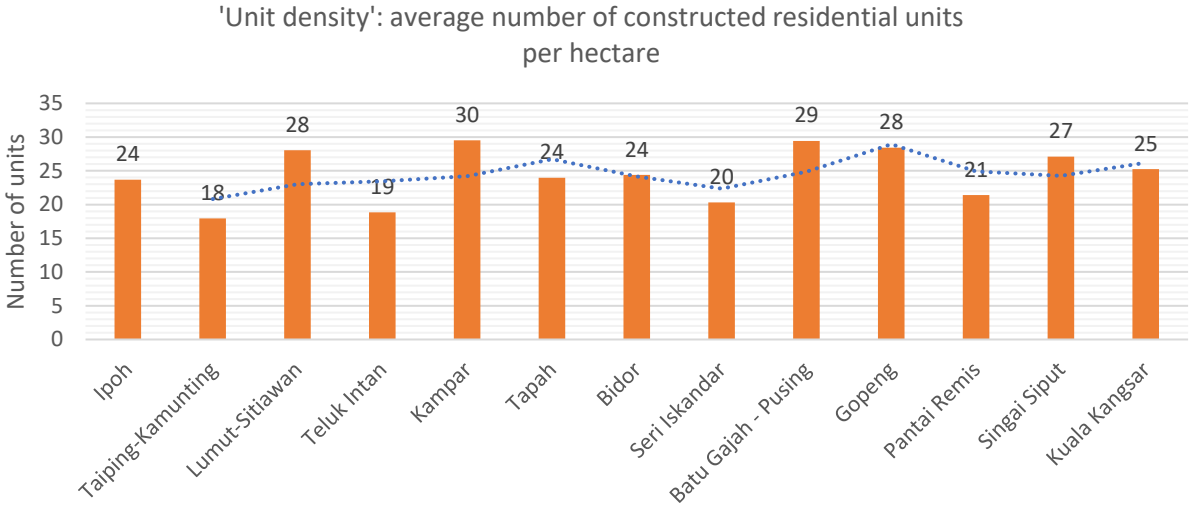
Considering the spatial distribution of newly constructed units per type, it can be observed that township projects have the highest number of units per project (figure 37). The township development 'Bandar Setia Awan' exists of most units, namely 10,500 which explains the high land consumption of this development. Furthermore, it can be observed that residential units indeed account for a large share of the total units under construction. In Seri Iskandar the number of units is considerably high, taking into account the size of this area (both in population as in built-up surface). The township development in Tapah is still in its first phase as it recently started with land clearing. The exact number of units that will be constructed is still unknown. However, the municipality of Tapah indicated that the total number will probably be between 2,000 and 5,000 units. Based on this information, for the analysis the lower boundary of 2,000 units has been used. Therefore, the actual number of units that will be added to the stock in Tapah might be higher.

Figure 37: Spatial distribution of the observed construction projects. The height of the bar indicates the relative size of the project, based on the number of units under construction. *Source: authors observations and calculations. Base-layer from Bing Maps (2019).*



To see whether variation exists between the compactness of developments, the average number of constructed units per hectare, defined as 'unit density', has been calculated (figure 38). Only residential- and township project have been included in this analysis. Industrial developments often exist of only one or two large units that consume lots of lands. Such outliers could impact the average. The average unit density of the current construction projects in the study area varies between 18 and 30 units per hectare, with an average of 20 units per hectare. Kampar shows the highest average, which can be explained by a high-rise development project 'Lake Campus Condominium', which exists of 1,050 units on a land plot of only 3 hectares. Overall, little variation can be observed. This can be explained by the fact that most of the observed developments within the study area were quite similar in size, namely low-density projects with 1 or 2 storey units. High-density developments, such as flats and apartments blocks, are less common in the study area, as will be discussed in chapter 8 and 9.

Figure 38: Unit density per urban area, expressed by the average number of units under construction per observed project. *Source: authors calculations and observations (2019).*



The results of these analyses will be used as benchmark to compare some specific development projects with the average of the urban area (see next chapter). Based on this, differences between projects and locations can be found in terms of compact development and efficiency.

To conclude, the spatial analysis of real estate development in the study area showed that most construction activity concentrates in- and around existing urban areas, and less so on inter-urban locations, left a few exceptions. Most construction activity can be found in Ipoh and Lumut-Sitiawan, which suggests the centrality of these nodes. Seri Iskandar is growing relatively fast and develops as a corridor between Ipoh and Lumut-Sitiawan. Furthermore, the analysis showed that township projects make a considerable impact and account for a large share of land consumption and units under construction. The next chapter elaborates on the efficiency of the development patterns, based on analyses on the local scale level.

8. Local development trends.

The previous chapters analysed spatial development patterns from the regional scale level. The results of these analyses indicated the differences in construction activity between different urban areas. This chapter aims to explain some of the underlying factors that help to understand the differences in construction activity, by zooming in to a lower scale level. As the urban areas of Ipoh, Taiping-Kamunting, Lumut-Sitiawan and Seri Iskandar stood out during the previous analyses, this chapter investigates local development trend for each of these urban areas in detail. For each urban area, recent construction projects have been visualized as an extension of current built-up areas, to understand how they impact urban form and whether this enhances an efficient development pattern that allows for building mass. Besides this, some development projects are discussed in detail. Overall, this chapter offers a more comprehensive understanding of development trends on the local scale level.

8.1 Ipoh

In Ipoh 66 construction projects were observed, with the highest concentrations located on the northern and southern part of the city (figure 39), similar to the 1990-2014 period. In the central part of Ipoh, a small number of construction projects has been observed. Interestingly, in the northern part of Ipoh, relatively large projects are located within the existing physical barriers (infill developments), which could be explained by the land availability in this area. This suggests that the northern part of Ipoh continues to develop in a compact way, by filling up the larger 'gaps' in the existing urban structure, in line with the built-up expansion in the 1990-2015 period. The southern part of Ipoh shows mainly residential projects and some industrial projects. These are relatively small compared to the inner-city developments in the north. An exception is the township development Bandar Seri Botani (location 1). This project is being developed by 'Taiko Group', a private company with headquarters in Ipoh and operations through south-east Asia and Europe. The project is built on former plantation land and consumes a total area of 507 hectares and a total of 7860 units will be constructed. Construction started around 2010 and is expected to take 13 years to complete. It aims to house an estimated population of 30,000. According to the developer, 5669 residential units and 165 shops have already been completed, constructed during different phases.

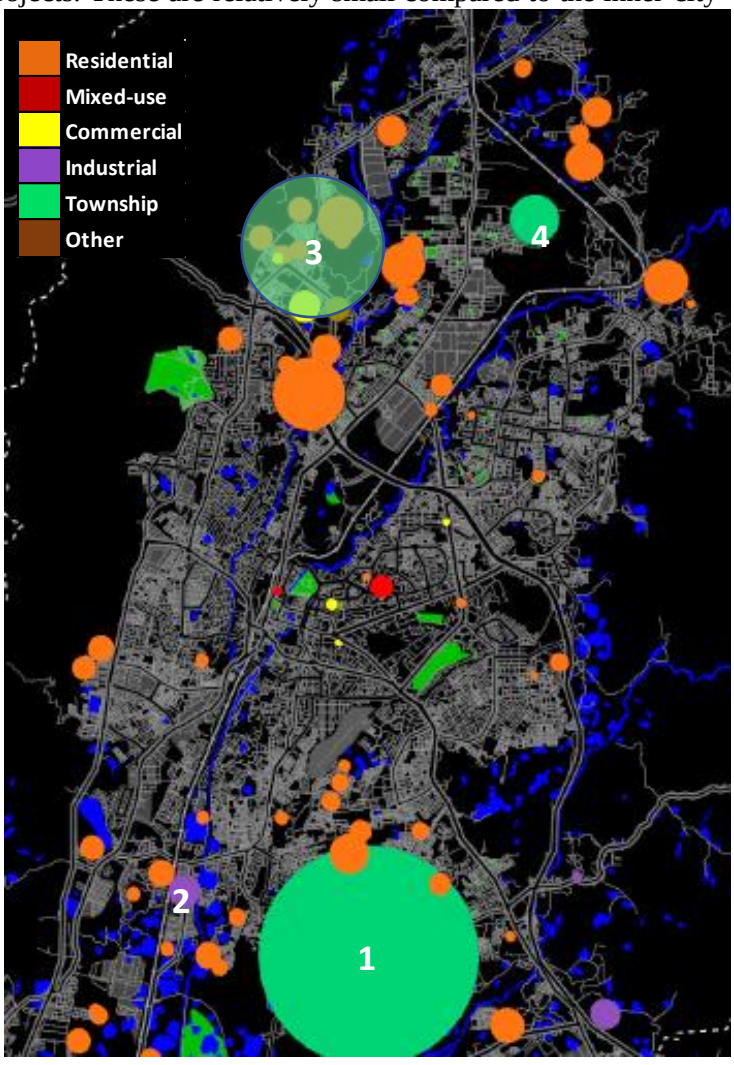


Figure 39: Spatial distribution of observed construction projects in Ipoh. The size of the circle represents the relative size of the project based on hectares land consumed.

Source: authors calculations and visualisations, based on fieldwork observations. Base-layer Bing Maps (2019).

In the northern part of Ipoh, projects are relatively large in size compared to the south (with an exception of the township project in the south). The northern part of Ipoh can roughly be divided into two 'construction zones', in the north-east and the north-west. One area is located in the north-western part of Ipoh and exists of multiple projects, most of them part of a larger township development under the name 'Bandar Meru Raya' (location 3). This township, which is largely completed, is strategically located across the North-South Highway, between Jelapang and Chemor. First signs of construction in this area date back to 2011 (figure 40). In 2019, this township is still partly under construction. This area is characterized by some high-rise developments, contributing to the compactness of the built-up form.

Figure 40: Expansion of the Bandar Meru Raya township. From left to right the construction status in 2011, 2016 and 2019. *Source: Google Earth (2019), multiple time frames.*

The township has become an important location for governmental agencies, as it houses offices of PKNP, the Ministry of home affairs, the Perak Foundation and more. While the first phase of this township is largely completed, multiple projects within this area are under construction, which can be considered as an expansion of Bandar Meru Raya. Different developers are responsible for these projects, namely Scientex; Kinta Properties; MK Land and Meru Properties. These projects include six residential developments, which together account for about 3,200 units and include two high-rise developments. Furthermore, thirty commercial units and an animation theme park are under construction. Together, these new developments consume a land area of more than 52 hectares. Taking into account only the residential projects in this area, the average 'unit-density' is around 73 units per hectare. *The compactness of the built-up expansion in this area is rather high,* as the average unit density of construction project in Ipoh is 24 units per hectare.

The developments that are under construction in the north-east are situated in a less densely built-up part of Ipoh. Together, these four projects in this area consume over 50 hectares of land, constructing around 3,318 units, which equals a unit-density of 63 units per hectare. Also, this area suggests a relatively compact development pattern. An example of a densely built project in this area is the township project 'Casa Residence North Ipoh' (location 4), where over 2,000 units are built on a land area of about 25 hectares (80 units/hectare). This project is part of the affordable housing schemes of PPA1M in Ipoh. The PPA1M programme is a federal initiative, implemented by the state in collaboration with local developers. These joint-ventures and affordable housing schemes are discussed in more detail in chapter 9.

Figure 41: Casa Residence township project in north-east Ipoh, located in a low-density built-up area. *Source: Ipoh Casa Residences (2017) and Google Earth, 2019*

Comparing the existing built-up area with the zoning-plans of Ipoh (figure 42), it can be observed that the 'gaps' in the existing built-up area allow for industrial, residential and institutional developments. In other words, on empty parcels of land that are located within the existing physical barriers of Ipoh, new built-up construction is allowed according to these zoning plans. Land parcels outside of the existing built-up areas are mainly zoned for forest and agriculture land use. Assuming that these 'guidelines' for land-use will not be changed, it can be expected that Ipoh will see more infill developments in the coming years, especially in the northern part of Ipoh, in line with current construction patterns. In this scenario, Ipoh's compactness can be expected to increase in the coming years. However, developers might transform agriculture land into residential land, which will affect the compactness of the built-up form. Therefore, exact directions of future built-up expansions are difficult to forecast.

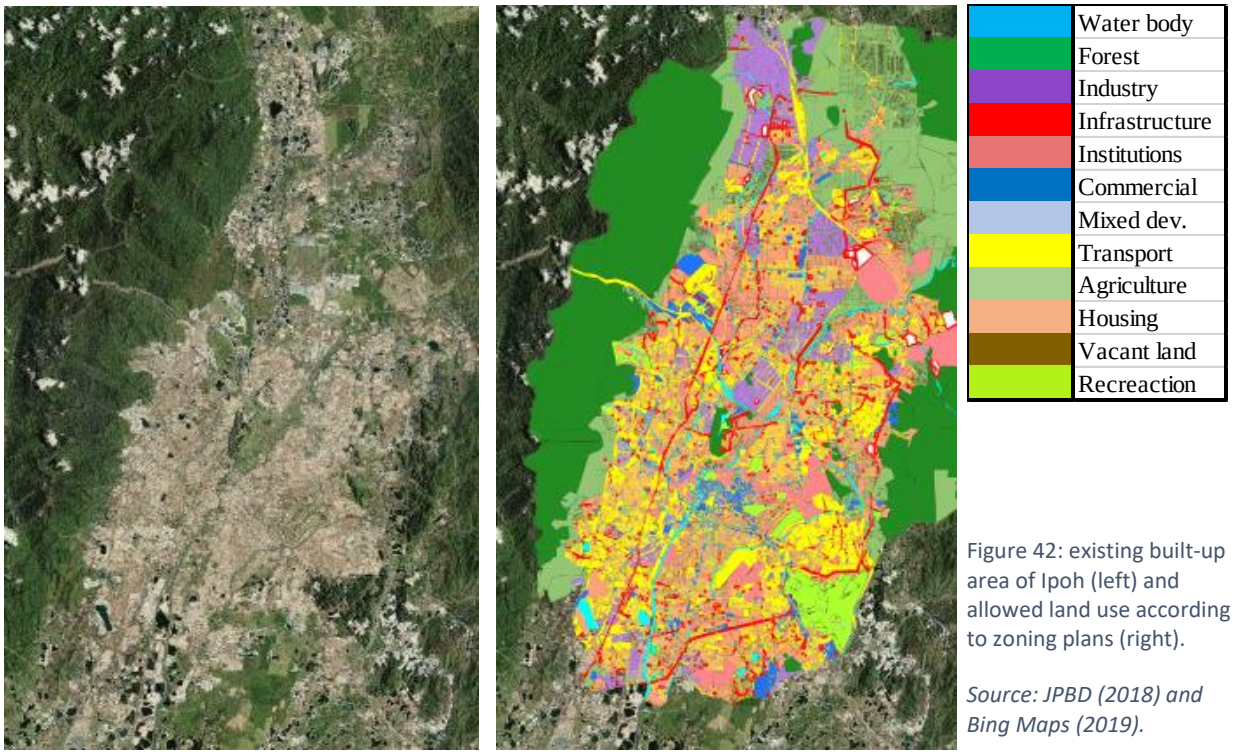


Figure 42: existing built-up area of Ipoh (left) and allowed land use according to zoning plans (right).

Source: JPBD (2018) and Bing Maps (2019).

8.2 Taiping-Kamunting

Compared to the urban areas of Ipoh and Lumut-Sitiawan, Taiping-Kamunting shows relatively little construction activity. In total, 31 projects have been observed. According to Mr Nazri, director of the Land Development Unit of the Land and Minerals office Perak (PTG Perak), the low construction activity in this area has to do with the fact that a large part of this area is considered as heritage area, which does not allow building construction. Considering the developers operating in this area, KL Teh Land & Development is the most active and responsible for multiple projects. Larger projects are mainly located outside the existing built-up area, such as PR1MA-at-Kamunting, an affordable housing scheme (location 5). This project has recently been completed and exists of 525 units in total. Other large developments in the area are two industrial developments, also in the west (location 6).

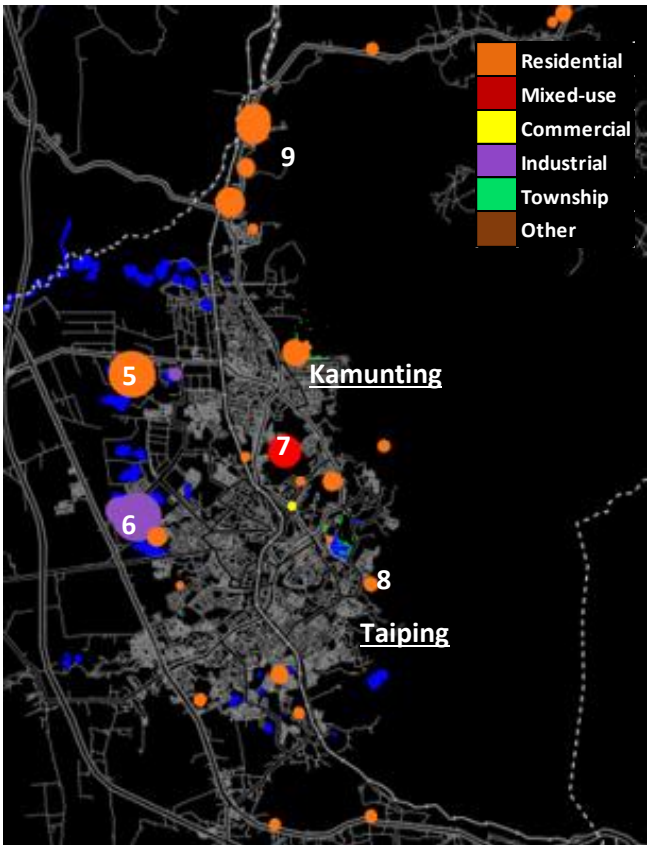


Figure 43: Spatial distribution of observed construction projects in Taiping-Kamunting. The size of the circle represents the relative size of the project based on hectares land consumed. *Source: authors calculations and visualisations, based on fieldwork observations. Base-layer Bing Maps (2019).*

An interesting observation during field trips were some redevelopments projects in the centre of Taiping. In fact, this was the only area were redevelopment projects were observed on inner-city locations. However, as these projects were rather small, they will not have a significant impact on the compactness of the built-up form. Another interesting project on an inner-city location is Taiping Heights, a mixed-use project developed by Sycal Ventures (location 7) on 20 hectares of land. In the first phase, 70 shops and 120 housing units are constructed, with an unspecified number of future units to be developed. Some high-rise developments were observed on the borders of Taiping, such as the 'Crystal Creek Resort' on the eastern part of Taiping, outside the centre (location 9). High-rise developments are less common in the area, and Perak in general, as most developments are characterized by 1 or 2 storey terrace houses. This common development pattern is the main reason behind the low population density in the urban areas in the study area, compared to dense areas such as northeast Penang and central Kuala Lumpur.

Figure 44: Two small size renovations projects in the centre of Taiping (left and middle) and a high-rise development outside the centre of Taiping (right). *Source: authors illustrations (2019).*

Another pattern that stands out can be observed alongside the road on the northside of the area (location 6). Developments in this area are interesting, as the surrounding land in this area is mainly designated for plantations and agricultural purposes. These scattered development patterns in plantations areas look random at first. However, according to Mr Nazri (PTG Perak), such development patterns are common and are sometimes part of development strategies of developers to transform agriculture land into residential areas.

Figure 45: A housing project in the middle of a plantation area (left) and a supporting irrigation channel (right). Source: authors illustrations (2019).

Scattered and sprawled patterns as development strategy.

Scattered developments alongside roads are a common pattern in Perak. According to Mr Nazri (PTG Perak), land plots located alongside roads have high development potential because of their high accessibility. He explains that scattered patterns of development projects are sometimes part of a strategy of developers, to transform large areas of agricultural land in residential areas. Such strategies are aimed to 'mislead' two type of actors, namely *landowners* (1) and *local authorities and land managers* (2):

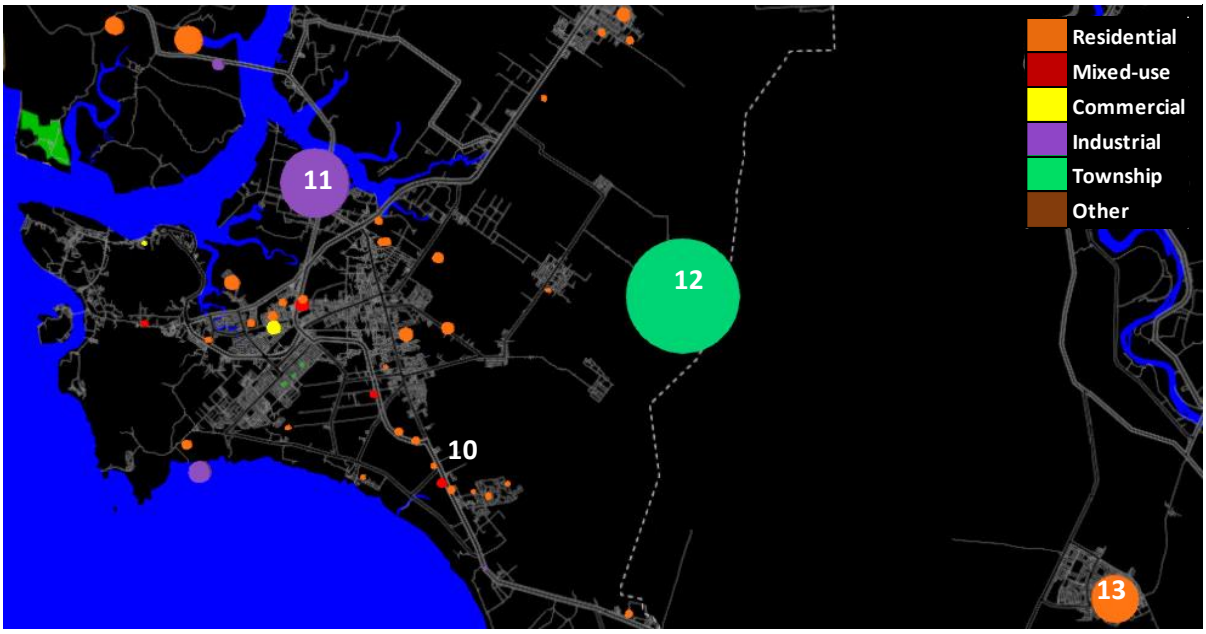
(1) When a developer plans to develop a location, he first buys one plot of land of a landowner that is willing to sell his land. He starts with the development of a small housing project on this location. Next, he will try to buy the land plot that borders the land to expand his housing project. However, sometimes land owners are unwilling to sell. In this case, the developer looks for another landowner who *is* willing to sell and starts a new housing project here. Bit by bit he starts to buy more land, until the landowner that was unwilling to sell in the beginning, has no choice than to sell his land, as his agricultural land is now 'stuck' in between a residential area.

(2) This strategy is also used to mislead local authorities. The developer will need permission of local authorities to re-zone the agricultural land use status into a residential status. As it is sometimes difficult to get permission for re-zoning of a large land area at once, he starts with the transformation of one small land plot. The developer continues doing so, until he re-zoned enough land plots to develop his housing project. For local authorities and land managers, this strategy is difficult to foresee, at it is only after multiple land transformations that such a trend becomes visible. By this time, it is too late to control it, as the land use status is already changed.

8.3 Lumut-Sitiawan

In Lumut-Sitiawan, 44 construction projects were observed, which makes it the second most active area in terms of building construction. The findings of chapter 6 showed that the built-up area expansion pattern in this area is a typical example of a sprawled urban area, characterized by urban expansion patterns that follow the main roads. Locations of current development projects show a similar trend. Especially in the southern part of the urban area, a pattern of construction alongside the road can be observed (location 10).

Figure 46: Spatial distribution of observed construction projects in Lumut-Sitiawan. The size of the circle represents the relative size of the project based on hectares land consumed. *Source: authors calculations and visualisations, based on fieldwork observations. Base-layer Bing Maps (2019).*



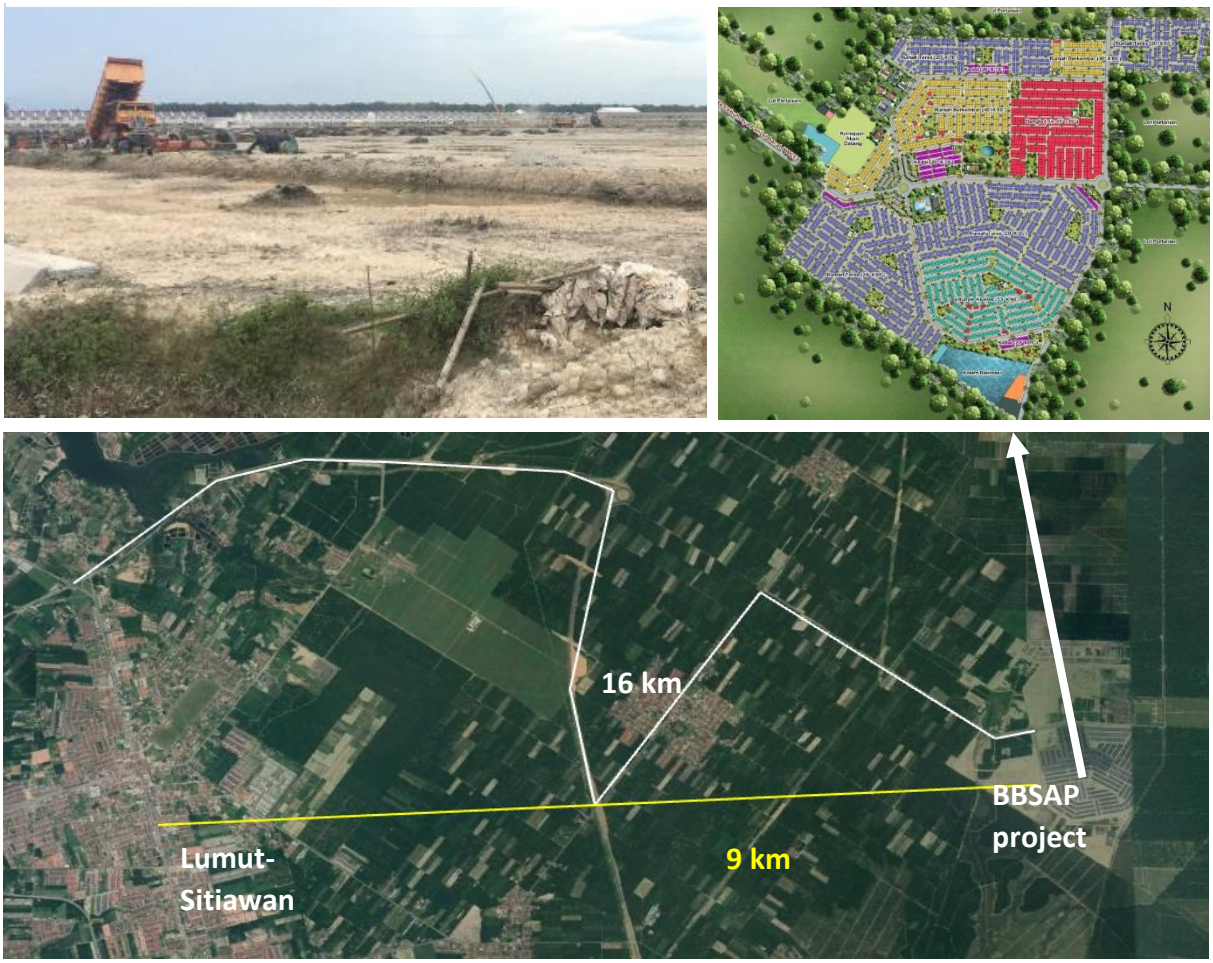
Interestingly, most of these projects on this location are developed by BluePrint Properties Sdn. Bhd. Together with YNH Property, these two local developers are the most active in the area and account for 13 of the construction projects. Mr Yu, director of Immanuel Construction & Development, a local construction company in Sri Manjung, explains the monopoly of these two developers on the local market. According to him, most of the private land in this area is owned by these large developers. The director of YNH properties, who owns over 1,000 hectares of land in this area inherited most of the land from his father (Yu, 2019, personal conversation). The costs that can be saved on land acquisition can be invested in construction materials, which allows for construction of high-quality housing, resulting in higher house prices. This drives up prices in the local market.

Scattered land ownership dates back to the colonial times.

According to Yu, the reason behind scattered land development patterns dates back to the colonial times. When Malaysia became independent and the British left the country, they had to sell their land to locals. These locals, in turn, give land plots to their children, who have more commercial mindsets and start to develop these land plots. This results in a scattered pattern of privately-owned land, which in turn explains (for a part) scattered land development patterns in the region (Yu, 2019, personal conversation).

Considering the larger projects in this area, three locations stand out. One of them is an industrial development in Lumut (location 11), located in the Lumut-Port area. This industrial expansion consumes 150 hectares of land in total. As this area is mainly purposed for industrial developments, this development has no significant impact on population distributions through this urban area. More interesting are location 12 and 13, two large inter-urban development projects. These projects are a typical example of an archipelago development pattern, as these inter-urban developments are located isolated as an island. Location 12, the township project 'Bandar Baru Setia Awan Perdana (BBSAP), is located 9 kilometres from the urban area of Lumut-Sitiawan. The shortest connection by road is 16 kilometres (figure 47). Such projects demand considerable investments in infrastructure.

Figure 47: The BBSAP-township project under construction, an example of an inter-urban development project on an isolated location. *Source: authors illustrations, Setia Awan holdings (2019) and Google Earth (2019).*



As discussed before, this township development is the largest project in the study area, with a total land consumption of 414 hectares and a total of 10,500 units under construction. This equals a unit density of 25 units per hectare, similar to the average of the other development projects in this area. Of the total, 1268 units are part of the federal affordable housing scheme PR1MA. Mr Ramat, manager at Setia Awan Holdings (the developer behind the project), says that all units will be sold for less than RM220,000. The target group for this project are the B40, the lowest 40% income group. The target group does not limit itself to people from Perak, as also people from other states will move to this project. In fact, Ramat

states that over 50% of the buyers come from outside Perak, mainly from Kuala Lumpur. He explains that the main reason behind this migration flow is that they get a high-quality house for the same price as they used to pay in Kuala Lumpur for a basic apartment. Besides this, the Westcoast Expressway, a new highway currently under construction, will be completed soon. According to Ramat, this new highway has a positive impact on the accessibility of this area, which makes this location extra interesting for buyers from Kuala Lumpur (Ramat, 2019, personal conversation).

For the realization of this project, Sitia Awan Holdings started a joint-venture with the previous government, which continues nowadays under the new government. This collaboration is mainly with state authorities, such as the PKNP. Ramat explains that the government supports them financially for this project. Also, he states that it works in their advantage to have the government on their side, as it creates more trust among buyers. For this project, the State did not offer them any land, and Setia Awan Holdings had to buy and re-zone agricultural land (designated for palm tree plantation) into residential status. According to Sabri (2019, personal conversation), joint-ventures between the government and local developers are a common strategy to develop affordable housing schemes in Perak. The 'Perakku Housing Scheme', an affordable housing initiative on the state level, is also realized by means of such public-private collaborations, as will be discussed in chapter 9.

Another inter-urban development residential project is located between Lumut-Sitiawan and Teluk Intan (location 13). The developer is Felcra Berhad, the Federal Land Consolidation and Rehabilitation Authority. Their core objective is the development of the rural sector. This small township exists of around 3,000 units, of which 1,400 are currently under construction. Mr Narais, general manager of this project, explains that Felcra owns all the land on this location. They started with the construction of this location in 1984 and target the local farmers and workers on the plantation areas. The new houses that are under construction (started in 2016) offer additional affordable houses, with prices below RM75,000 (Narais, 2019, personal conversation). Their aim is to provide affordable houses for their workers, who don't have a sufficient income to be applicable for bank loans. Mr Narais states that Felcra expects that the demand for houses on this location will increase after the completion of the Westcoast Expressway (Narais, 2019, personal conversation).

8.4 Seri Iskandar

In Seri-Iskandar most of the built-up area emerged only during the last decades, as discussed before. A large share of the built-up area exists of universities and campuses. This is reflected in the land use statistics, as 39% of the existing built-up land in this urban area is characterized as institutional land, which is considerably higher compared to the other urban areas (see appendix 7.1). Considering the spatial structure of the built-up form, a rather inefficient and sprawled structure can be observed. The current built-up expansion in this area is relatively high, namely 171 hectares, which equals an additional share of 7% of the existing built-up area.

Current residential projects in Seri Iskandar follow a similar pattern as during the previous decades, with most projects constructed alongside the road. These developments are characterized both by landed houses as high-rise condominium projects. Ramat (2019, personal conversation) explained that the

target group of most of these residential projects are local students. Setia Awan Holdings also constructed projects in this area before, namely 500 commercial units and 800 residential units. According to Ramat, they sold most of their residential units to investors. In turn, these investors rent out the studios to students. Ramat also explains that currently, most students move to larger cities such as Kuala Lumpur after graduation, looking for jobs. Ramat sees this outflow of human capital and talent as a missed opportunity for Seri Iskandar and the region as a whole. To stimulate more local jobs, Sitia Awan Holdings also constructed commercial projects in the past, with the goal to stimulate local economic activity and create a more attractive business environment for students (Ramat, 2019, personal conversation).

Figure 48: Spatial distribution of observed construction projects in Teluk Intan. The size of the circle represents the relative size of the project based on hectares land consumed. *Source: authors calculations and visualisations, Base-layer Bing Maps (2019).*

This chapter discussed local development trends. While Ipoh develops in a relatively compact way, characterized by dense infill developments, this is not the case for Lumut-Sitiawan and other urban areas, where low-density peripheral developments can be identified, impacting the efficiency of urban form. The following chapter elaborates on the drivers behind these developments.

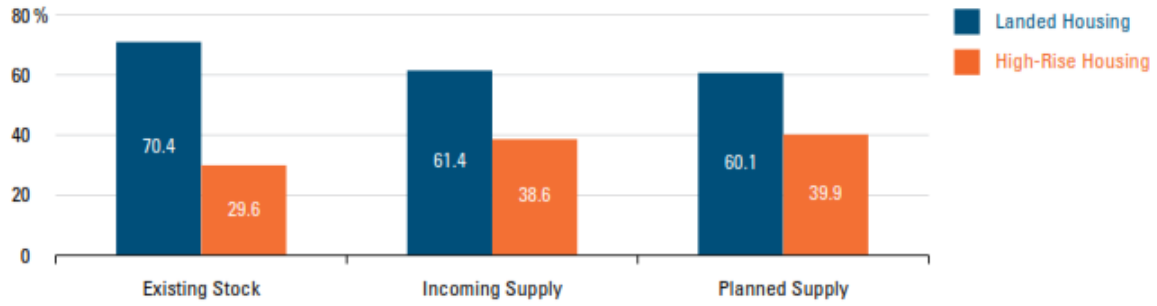
9. Development context and influential (f)actors

Chapter 5 and 6 offered an overview of population- and construction patterns in the study area from a regional perspective. Chapter 7 zoomed in to a lower scale level and explored development trends and locational characteristics per urban area. As stated before, real estate development does not occur in a vacuum, as development processes take place within a certain context and are influenced by external factors. Aim of this chapter is to elaborate on the drivers behind the observed development patterns. It does so by analysing the differentiation in land costs in the study area; explaining the impact of affordable housing schemes; and explaining the inefficiency of zoning plans. These insights will offer a more comprehensive understanding of the functioning of local development markets.

9.1 Drivers behind low-density peripheral development

Considering Malaysia's existing residential stock, it can be found that landed houses[6] indeed dominate the market with a 70,4% share, while high rise housing[7] account for a market share of 29,6% in 2017 (KRI, 2019). However, this trend is reversing, as reflected by the percentual change in the incoming- and planned supply (figure 49). This trend reflects Malaysia's urbanisation level and the need for more vertical developments in concentrated spaces (KRI, 2019).

Figure 49: Housing supply in Malaysia in 2016. *Source: KRI, 2019, p. 77. Calculations based on data from NAPIC, 2017.*



However, as observed during the field trip, low-density peripheral developments still dominate the development market in Perak, characterized by landed housing developments on the city's borders. There are multiple reasons for this, as explained by Mr Ramat, manager at Sitia Awan Holdings (a private developer in Seri Manjung) and Mr Sabri, Deputy CEO of LPHP. The first reason is that people simply prefer landed houses over high-rise condominiums. Ramat explains that during the planning phase of a new project, they conduct a survey among potential buyers to ask their preferences for housing types. Results of such surveys always indicate a strong preference for landed houses (Ramat, 2019, personal conversations). Sabri confirms this and states that people prefer to have a landed house on the city's border, rather than an apartment in the centre of the city. In fact, he explains that it is difficult to sell units of high-rise developments, even when they are located in central locations (Sabri, 2019, personal conversation). The second reason is the high availability of land in Perak, which exists off mainly rural areas. Even when zoning plans identify land as agricultural status, it is relatively easy to transform the land use for development purposes. Land availability also drives the site-selection process for affordable housing schemes, as they often locate on locations were the land supply is high, under the assumption that the low land costs on these locations allow for lower housing prices. The problem with this theory is that it fails to recognize the fact 'that housing affordability is an interplay of diverse

[6] Landed houses includes terraced, semi-detached, detached, and cluster houses (KRI, 2019).
[7] High-rise housing included condominiums, flats, low-cost flats and town houses (KRI, 2019).

factors', and not of land costs only (KRI, 2019, p. 137). These assumptions, however, are widely adopted among developers, which explains their preferences for peripheral development. In turn, this results in urban sprawl phenomena and affects the compactness of urban development patterns.

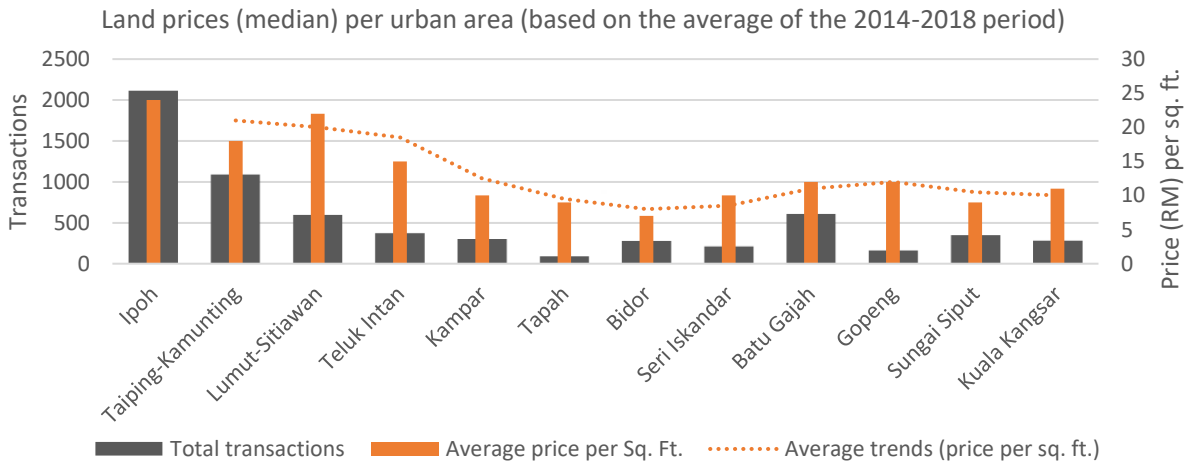
Figure 50: *two examples of low-density peripheral development projects in the study area. Source: authors illustrations (2019).*

As land costs are identified as an important factor impacting site-selection decisions, the following paragraph discusses the spatial differentiation of land prices in the study area in more detail.

9.1.1 Spatial differentiation in land prices

According to Yu, director of a construction firm, land costs are high in Lumut-Sitiawan, comparable with that of Ipoh. He explains that one of the main advantages of Lumut-Sitiawan is the strategic location on the coast of an important shipping lane. The Lumut Port acts as stop-over for ships travelling through the Strait of Malacca (-the main shipping channel between the Indian Ocean and the Pacific Ocean, which is considered as one of the most important shipping lanes in the world-). This makes the location attractive for industrial companies. As a result, overseas investors, mainly Chinese, come to this region and look for temporary housing. One of the largest companies that invest in this region is 'Vale Malaysia Minerals', a global mining company. Another example of a project that impacted the local housing market was a powerplant constructed seven years ago. For the construction of this powerplant, lots of workers migrated to this area, which resulted in high demand for housing. This attracts developers from other regions to Lumut-Sitiawan and drove up the prices. For the smaller developers with less financial capital, developing in this area is unprofitable. Yu's company, for example, is not active in this area and operates mainly in other areas, such as Taiping-Kamunting, as land costs in this area are lower (Yu, 2019, personal conversation). To confirm these statements, an analysis of land prices has been conducted.

Figure 51: Land transactions per urban area. The median price is based on the average transaction costs in the period January 2014 – January 2019. *Source: authors calculations, based on data of JPPH (2019).*

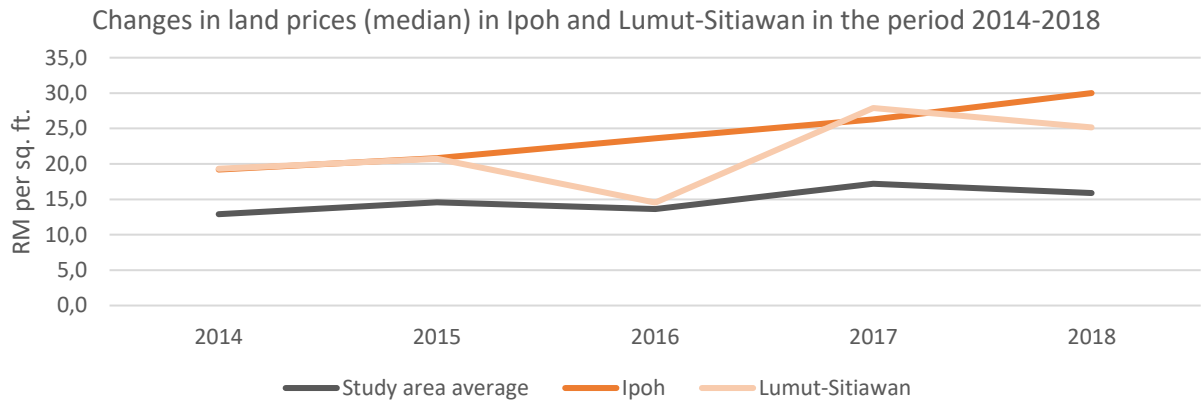


During the 2014-2018 period, 10698 land transactions were recorded in Perak. The thirteen urban areas that are central in this research, together account for 8179 transactions, 77% of the total of Perak. The average land price in the study area is 13 RM/sq.ft. Most land transactions were found in Ipoh, a total of 2116. Results of the analysis show that land prices are indeed the highest in Ipoh and Lumut-Sitiawan, namely 24 RM/sq.ft. and 22 RM/sq.ft. respectively (figure 51). This trend corresponds with the fact these urban areas also showed the highest selling prices for residential units. It can be assumed that these findings are interrelated. However, it is difficult to say whether the high land prices are the results of high housing prices or the other way around. Nevertheless, the findings suggest that the concentrations of construction activity in Ipoh and Lumut-Sitiawan influences land- and housing prices.

According to Nazri, director of the Land Development Unit of PTG Perak, lower land costs in Seri Iskandar make this area interesting, as developers can still offer reasonably priced houses on a strategic location, which makes them easier to sell (Nazri, 2019, personal conversation). The strategic advantage of this location can be explained from a geographical point of view as it is located between Ipoh and Lumut-Sitiawan.

Considering changes in land costs over the 2014-2018 period, it can be observed that these have been rising over the years (figure 52).

Figure 52. Rising land costs in the study area. *Source: authors calculations, based on data of JPPH (2019).*



The average median land costs in the study area increased from 13 RM/sq.ft. in 2014 to 16 RM/sq.ft. in 2018, a 23% increase. Ipoh shows the strongest increase, namely from 19 RM/sq.ft. in 2014 to 30 RM/sq.ft. in 2018, a 58% increase. Land costs in Lumut-Sitiawan increased from 19 RM/sq.ft. to 25 RM/sq.ft., a 32% increase. It is highly likely that these sharp increases in land prices are influenced by the high concentrations of construction activity in the 2013-2017 period in these urban areas. Changes in land prices for the other urban areas can be found in appendix 10. In these areas, changes in land prices vary over the years and show overall less strong increases compared to Ipoh and Lumut-Sitiawan. In Batu Gajah and Kampar land prices even declined.

The analysis confirms statements of developers that there is a geographical variation in land prices between the different urban areas. Indeed, land prices seem to correlate with locations of construction activity and selling prices of residential units. The variation in land prices also plays a role in site-selection processes for affordable housing schemes, as will be discussed in the next paragraph.

9.2 Impacts of affordable housing programmes

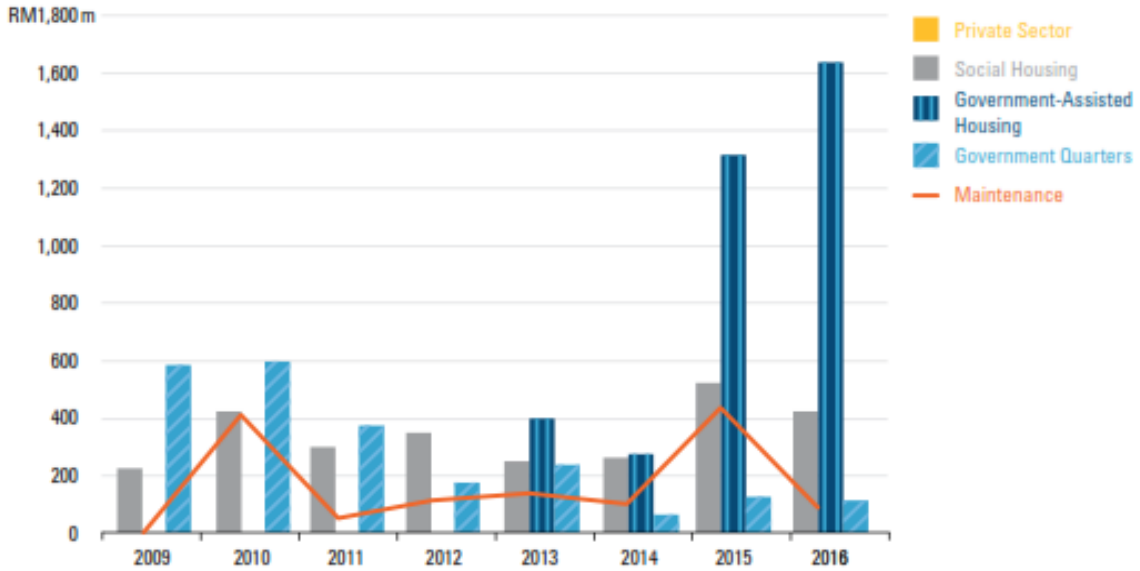
The provision of affordable homes remains a major problem facing policymakers in Malaysia. Housing affordability in the country has not improved significantly between 2002 and 2016, which has partly stemmed from the unresponsiveness of housing supply to effective demand (KRI, 2019, p. 9-10). As a result, housing prices in Malaysia have been increasing over the years. In 2014 the calculated median house price of an affordable home was RM65,060; in 2016 this was RM188,208 (KRI, 2019). Of all the new units launched, only a small percentage fall into the category affordable houses: similar trends can be observed at the state level.

Characteristics of the Malaysian housing market

The Malaysian housing market can be characterized as a 'buyer-market'. In 2016, only 20% Malaysian households rent, of which 47% are from the B40- income group and 44% M40- income group. The proportion of renters is likely to be higher in rural areas than in urban areas. A large share is renting from the private market, as social housing only constitutes about 1,5% of the total stock in Malaysia (KRI, 2019). Home ownership stood at 73% in 2010 (the year of latest population and housing census). In urban areas, home ownership rates are somewhat lower, namely 69%. In Perak, home-ownership stood relatively high, namely 76%, in contrast to 54% in Kuala Lumpur (KRI, 2015).

To stimulate the supply of affordable housing, the government started to increase its development expenditure (devex) by offering funds for government-assisted housing, especially since 2013. Government-assisted housing made up 45% of housing devex in 2013 and has been rising to 75% in 2016, according to calculations of the Khazanah Research Institute (2019). Indeed, it can be observed that expenditures on government-assisted housing increased rapidly since 2014 (figure 53).

Figure 53: Federal government's expenditures on housing development and maintenance in 2009-2016 (RM millions). *Source: KRI (2019, p. 160).*



These expenditures of the government translate mainly in home-ownership programmes, which were announced in the 10th Malaysian Plan. Two well-known examples of such affordable home-ownership housing schemes are PR1MA and PPA1M. These initiatives make a considerable impact on urban areas in the study area as shown before. PPA1M is an affordable housing scheme aimed at helping civil service employees to own quality homes in strategic locations at affordable prices. The programme was

launched in early 2013 following the decision by the Cabinet that year. (House prices vary between RM90,000-RM300,000. The monthly of applicants may not exceed RM7500.) The other, PR1MA Malaysia, was established under the PR1MA Act 2012 to plan, develop, construct and maintain high-quality housing in key urban centres. For the realisation of this programme, the government form joint-ventures with private sector developers to build PR1MA homes. (House prices vary between RM100,000– RM400,000. The monthly income of applicants should be between RM2,500–RM15,000). The government's priority shifted towards these type of housing schemes, which is reflected in the total devex of the government on PR1MA and PPA1M: an increase of 316%, from RM390 million in 2013 to RM1,6 billion in 2016 (KRI, 2019). The actual implementation and realization of these affordable housing schemes are executed by State authorities, often in collaboration with local developers, both from the private as from the public sector.

Considering the locations and characteristics of these projects (appendix 6), it can be found that these projects are often located on peripheral or inter-urban locations, often characterized by hundreds of low-density landed houses. Such developments can be considered as inefficient, as the isolated locations demand considerable investments in infrastructure. The next paragraph discusses the main actors who are involved in these processes in Perak.

Inaccurate data as explanator of housing vacancy.

During fieldwork trips, lots of vacant and unutilized affordable houses of PPA1M and PR1MA were observed. A reason for the high vacancy might lay in the fact that, in general, state governmental agencies do not collect or utilise on a frequent basis data on households, to monitor the demand for housing in their localities. According to the Khazanah Research Institute (2019), this lack of accurate might lead to an oversupply of units, not in line with the actual demand for affordable houses. This mismatch between demand and supply might explain the high vacancy of the observed affordable housing projects.

9.2.1 Realization of affordable housing programmes through public-private partnerships

This paragraph elaborates on the process of how national housing policies are implemented on the State level and how this eventually leads to the physical realization of affordable housing schemes. This process is crucial to understand, as affordable housing policies are a driver behind real estate development in the study area. From a supply-perspective, the Federal- and State governments mainly focused on the direct provision of affordable homes, either through public agencies or through partnerships with private developers. The Perak Housing and Property Board (LPHP) plays a key role in this. LPHP is a governmental agency responsible for the regulation, promotion, coordination, facilitation and implementation of housing- and property development in Perak, mainly focussed on public and affordable housing. LPHP is responsible for both the regulation of policies as for the actual implementation. Mr Sabri, deputy CEO of LPHP, explains that for the realization of affordable housing programmes, LPHP works together with other (local) parties, both in the private as in the public sector. In the public sector they collaborate with State GLC's (Government Linked Companies), such as PKNP. Until now, 43.000 affordable houses have been planned in collaboration with GLC's (excluding the private sector developments), which are partly under construction. Besides the collaboration with GLC's, LPHP forms joint-ventures with developers in the private sector. Such joint-ventures are desirable for both parties. The State Government offers a piece of land to LPHP, after which LPHP selects a private developer to develop the land. By offering 'free land' with low premiums to developers,

the government aims to stimulate developers to build more houses for low prices. In some cases, LPHP also gets some houses in return, which they can sell to make profits (Sabri, 2019, personal conversation). LPHP also advises the state authorities on policies and strategies that should be adopted to promote the development of housing and other property. For the formation of new policies, they work closely together with the Real Estate and Housing Developers' Association (REHDA). REHDA is involved in the discussion about what selling prices of houses should be; how many units they should build; and which developers in the private sector are suitable for the realization of the projects. Based on this advice, new policies and affordable housing programmes are introduced

9.2.2 State-level initiatives: the Perakku housing programme

In 2018, Perak's previous government launched its first phase of the 'Perakku' housing programme. The Perakku Housing programme is a reaction to the shortage of affordable housing in Perak: LPHP found that between 2013-2017, only 1,24% of the total 61,658 new approved housing units were low-cost houses. To stimulate the supply of low-cost houses, the 'Perakku' housing programme was initiated under the Perak State Housing Policy (DPNP), which aims for the development of 52,000 affordable houses by 2022. The Perakku housing programme will be carried out in several stages and offers three categories of homes, which are low-cost; low- and medium cost; and affordable housing (Sabri, 2019, personal conversation). The price ranges of these houses are shown in the table below (Table 5).

Table 5: Price categories of 'Perakku houses'. *Source: Data obtained from LPHP (2019).*

Housing category	Price category	Unit price (urban area)	Unit price (rural area)
Perakku 1	Low-cost	RM 90,000	RM 70,000
Perakku 2	Medium-cost	RM 180,000	RM 140,000
Perakku 3	Affordable housing	RM 250,000	RM 240,000

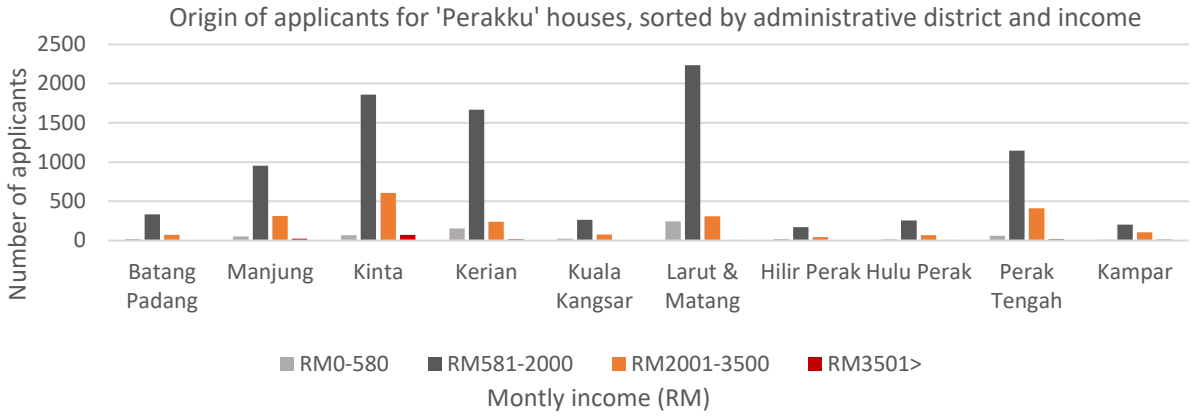
The government constructs these houses via LPHP, through joint-ventures with local developers in Perak. Until now, 6,949 units have been completed, 10,500 units are under construction, and 34,808 units are in the planning phase (Nazri, 2019, personal conversation). Mr Sabri and Mr Nazri both confirmed that most of the observed construction projects include Perakku houses. This indicates that the 'Perakku' housing programme, under the DPNP, is a factor that drives real estate development in the study area. The Perakku houses are built in several areas in the state, in all the districts, both in rural and urban area, and are mainly aimed for the B40-group (monthly household income below RM3000). Until now, LPHP received over 13,000 applications for the Perakku houses. Most of the applicants (75%) have a monthly income between RM581-RM2000 (table 6).

Table 6: Applications for the Perakku housing programme, sorted by monthly household income of the applicants. *Source: Data obtained from LPHP (2019).*

Monthly household income	Number of applications	Percentage
RM0 - RM580	766	6%
RM581 - RM2000	10,366	75%
RM2001 - RM3500	2548	18%
RM3501 - higher	186	1%
Total	**13,866**	**100%**

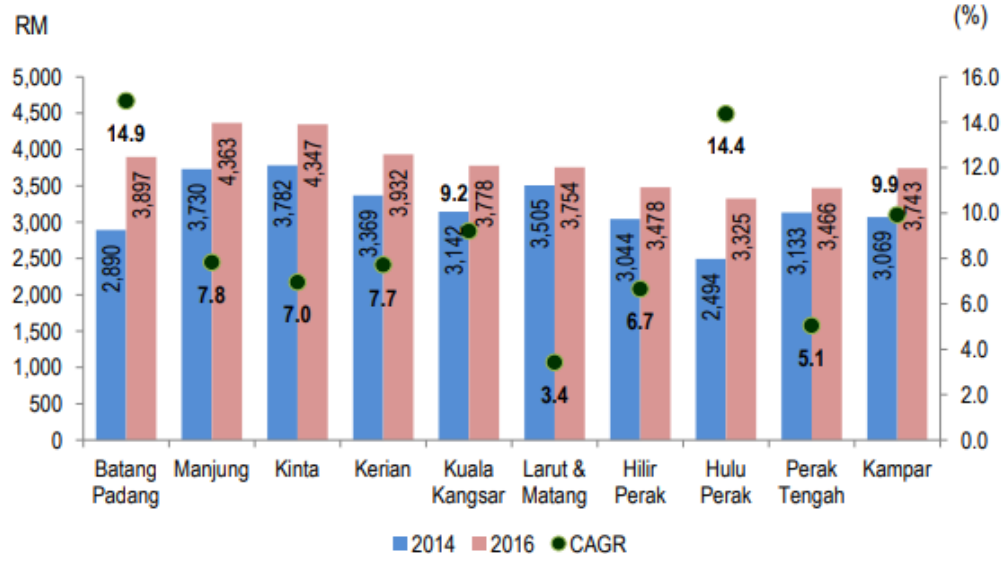
Mr Sabri explains the site-selection for new 'Perakku houses' are based on household incomes of administrative districts, which are used as proxy to determine new locations of affordable housing projects (Sabri, 2019, personal conversation). In other words, LPHP considers the spatial differentiation of household incomes to choose locations for new developments. Considering the origin of the applicants for Perakku houses, indicated by the district in which they currently live, some interesting observations can be made (figure 54). Looking at the RM581-RM2000 income group, it can be observed that the largest share of applicants from this group lives in the Larut & Matang district. Another large share comes from the Kinta district. Furthermore, Manjung and Perak Tengah also account for a relatively large share, just as the Kerian and Mualim district. The latter two districts, however, are located outside the study area.

Figure 54: Origin of applicants who applied for 'Perakku' houses. Sorted by administrative districts and monthly household income. *Source: authors calculations, based on data from LPHP (2019).*



These findings are compared with the median monthly household income for each administrative district (figure 55). Considering the annual growth rates of the monthly household incomes (CAGR[8]) per district, it can be observed that the districts that show the highest growth rates account for a small share

Figure 55: median monthly household income per administrative district, Perak, 2014 and 2016. *Source: DOSM (2017).*



[8] * *CAGR = Compounded annual growth rate (%)*

of the applications for affordable houses. The same goes the other way: districts that show little growth in household incomes, account for a large share of the applications for affordable houses. For example, Batang Padang and Hulu Perak show the highest annual growth rates of household incomes during 2014 and 2016 (figure 55). Interestingly, these districts account for a small share of the applications for affordable houses in the 'Perakku' housing programme (figure 54). In contrast, the Larut & Matang district shows the lowest annual growth rate of household incomes: these districts account for the largest share of the applications. This trend can be observed for all districts, with an exception of Hilir Perak. These findings indicate that most of the applicants who apply for affordable houses of the 'Perakku housing programme', live in those districts where the annual household income growth is low. This suggests that from the demand perspective, *household income growth* (rather than the actual household income), is an indicator for where the demand for affordable houses is the highest.

Price control: power of the State

Development proposals are subject to approvals from local authorities and the price of every housing unit must be stated in the development proposal. State authorities have the power to enforce their housing policies, to ensure that home ownership for low-income target groups are not affected by 'free market' practices of private developers determining house prices. This include quotas on the provision of low-cost, medium-cost and affordable houses (KRI, 2019, p. 119).

Affordable housing policies obligate developers to include affordable houses in their housing project in two scenarios: (a) when a developer starts a project on a land plot larger than 20 acres, or; (b) when the developer constructs over 300 units. Previously, developers were obligated to construct minimum 30% low-cost houses for every housing project. As this financial construction was unprofitable for most developers, it resulted in a situation where most of the affordable houses that should have been built, were not implemented. Also, developers were not obligated to build affordable houses in *the first phase of the project*: they were allowed to construct the affordable houses in later development stages. During the later stages, some developers went to the State Government for an appeal not to develop low-cost houses. In this case, they need to pay a levy to the government. This way they could avoid to developer low- and medium cost houses.

To stimulate the supply of low-cost houses in Perak, REHDA and LPHP recently (April 2019) introduced improvements to the Perak State Housing Policy (DPNP), which offers a more attractive business case for developers. For high-density housing construction (over 8 hectares), developers can now choose from different 'components'. More specific, in these situations they need to build at least 10% low-cost houses (Perakku 1); 20% middle cost (Perakku 2); and 20% affordable houses (Perakku 3). For the other 50%, the developer can sell units at market prices. This financial construction is more attractive for developers. Also, developers are now obligated to include low-costs houses in the *first phase* of the project. These adjustments to the former policy must encourage private sector participation in the construction of affordable houses (Sabri, 2019, personal conversation).

9.3 Inefficient land management as a driver of scattered development patterns

As indicated before, a common pattern in the study area is low-density peripheral development, which often negatively affect the compactness of urban form. Developers often choose to build on peripheral locations as land costs on these locations are lower. After the purchase agricultural land, they need to go through certain legal procedures to transform the agricultural status into building status, a process called re-zoning. This paragraph discusses these re-zoning processes and suggests that the inefficiency of zoning plans is a driver behind these sprawled development patterns.

For the realization of more efficient urban development, *'housing planning should be integrated with transportation and other land-use planning, and not be seen in isolation from other sectoral forces at play'* (KRI, 2019). As explained before, isolated developments are indeed inefficient, as they demand additional investments for infrastructure and results in longer travel times, negatively affecting the environment and undermining agglomeration economies. Malaysian urban planners seem to be aware of this, indicated by some degree of sectoral coordination between transport and land-use planning, as evidenced by the National Physical Plan (NPP) and state structural plans (KRI, 2019). However, this 'theoretical awareness' is not found back in reality, as shown by the current physical development patterns, which suggests that certain gaps exist between planning and effective implementation. To understand what these gaps are, the process of the formation of physical- and zoning plans must be understood.

9.3.1 The formation of zoning plans

To understand more about land development processes, an interview has been conducted with Mr Nazri, head of the land development unit of PTG Perak, the Land and Mineral Director Office on the state level. PTG is a land administration- and management office, which acts as one of the main frontline agencies of the state government. Nazri explains that the formation of zoning- and physical development plans are organized on three different scale levels: national, regional (state) and local. The Department of Town and Country Planning (JPBD), also known as PlanMalaysa, is responsible for the formation of structural plans. On the national level JPBD prepares the NPP, on the state level the State Strategic Plan, and on the local level they create Local Plans.[9]

The State Structural and Local Plans are financed by the federal government and the state government. Usually, 70% is contributed by the Federal Government and 30% by the State Government, as local authorities lack adequate financial resources. In this stage, drafts for Local Plans are often in line with the State structural plan, because of the direct involvement of state authorities. Governments work together with private consultancy firms and town planners, as well as landowners and, to create a zoning draft plan. When the draft is completed, they invite the public to comment on the plan and whether they agree with the zoning-plans for certain areas. This public engagement is called a publicity programme. Based on this response, they prepare the final plan in detail. Every land plot will be assigned to the related zoning. This plan goes to the State Planning Committee, the highest state planning authority. They approve the 'final' zoning of the Local Plans (Nazri, 2019, personal conversation).

9.3.2 The power of local authorities in controlling re-zoning processes

It is important to realize that the timeframe for a Local Plan is long, namely twenty years. For example, the new Local Plan for Ipoh will be finished in 2020 and will be used until 2035-2040. Because of this

[9] An overview of the Malaysian planning framework can be found in appendix 4.

long timeframe, the original zoning plans will be subject to contextual changes, such as changes in land ownership or a higher demand for land. To deal with such issues, it is possible to adjust the original zoning plans, a process called re-zoning. Reasons behind the desire to transform land-use status can be twofold. One scenario is that a landowner himself wants to transform the status of his land-use. However, more often the landowner sells his land to a real estate developer, who wishes to use the land for building purposes.

In this case, there are two items that the developer needs to convert through a legal procedure: the zoning plan itself and the land title. Mr Nazri explains that the most popular legal procedure is under section 124. Under this section, an application can be made to the state authority for the alteration of any category of land use (Nazri, 2019, personal conversation). This legal procedure of re-zoning and the actors involved in this process are discussed in detail in appendix 12 (interview with Nazri). In short, this procedure means that a developer submits a land-use transformation application and a planning permission to the local authority (the district land office). After the application and planning permission have been approved by local authorities, the documents are sent to PTG Perak, where the state committee will make the final decision of the approval of re-zoning.

So, the final decision for re-zoning approval is made on the *state level*. However, Mr Nazri explains that the final decision of the state committee is almost always based on the recommendation of the *local* district officer, who is seen as the local specialist. The local land administrator suggests to the state committee whether a land-use transformation application should be approved or rejected. This suggests that even though the final decisions for re-zoning is made on the *state level*, the *local* authorities have the power to control and guide these outcomes (Nazri, 2019, personal conversation). This lack of efficient coordination by state authorities results in a situation in which adjustments to Local Plans are often not in line with the visions of the State Structural Plan. In turn, this indicates the difficulty to implement and realize regional development plans.

9.3.3 Influence of land-tax systems on re-zoning processes

According to Mr Nazri, re-zoning approvals from state- and local authorities are often based on their financial ambitions. In fact, state- and district offices stimulate land transformation and real estate development, as they need these land revenues to reach their financial targets (Nazri, 2019, personal conversation). In the case of Perak, the total state revenue (rent, premiums, etc) that stems from land development is RM600 million a year, which is relatively low compared to other states. For example, in Selangor (another state in Malaysia), the most developed district is Petaling, which itself contributes already for RM600 million a year. This is because this district is highly developed with housing and industry. In Perak, land revenues are less high, as most of the land is agricultural land. To increase the revenues from land, governments can stimulate the development of agricultural land, as the annual 'quit rent', a form of land-tax, of residential and industrial land is higher than that of agriculture land.

Quit rent system

The government of Malaysia maintains its share of unique laws and regulations. One specific form of land tax which falls under the Malaysian law is known as *quit rent*. Quit rent constitutes a form of tax levied against all alienated land in Malaysia (alienated land constitutes any leased land owned by the government, or any land formerly owned by the government). Though mandated by federal law, state governments assess and collect all quit rent. Quit rent rates hinge on land usage – agriculture, housing, residential, or other properties—and total hectares possessed (Gish, 2019; Nazri, 2019, personal conversation).

Considering revenues from the ‘quit-rent’ only, the total of Perak is RM218 million (January-June 2019). The Kinta district accounts for the largest share, namely RM68 million, or 31%. Manjung has the second-highest contribution, RM35 million. The quit-rent is the highest in these districts, as these account for the largest property stock and construction activity. The financial target for December 2019 from quit rent revenues in Perak is higher than the RM218 million reached so far. As the target is not yet reached, local- and state authorities will allow for more land transformations and give permission for most development applications (Nazri, 2019, personal conversation).

This confirms the statements of local developers, who explained that it is relatively easy to transform land-use status and to adjust zoning plans. In fact, Yu, a local developer in Manjung, stated that he never heard of a situation in which a developer was not allowed to adjust the zoning-plans for residential developments (Yu, 2019, personal conversation). Mr Nazri acknowledges the fact that there exists some form of contradiction in the system: governments spend a lot of money on the formation of zoning plans, while the land-owners and developers have the power to adjust these plans (Nazri, 2019, personal conversation).

This chapter characterized the local development context in which real estate developers – and other supporting actors – operate. Several external drivers have been identified, such as land availability and household incomes, which influence site-selection decisions for private development projects and affordable housing schemes. The inefficiency of zoning plans, driven by financial ambitions of local governments, stimulates scattered development patterns in the study area and undermines the capability of land managers to control and coordinate land development.

10. Conclusion and reflection

The analysis conducted in this research defines the morphological characteristics of the regional urban structure of Perak, in Peninsular Malaysia. Driven by the recognition that Peninsular Malaysia's urban system and its main cities face several challenges in respect of spatial structure, the research unravels the shortcomings of a hierarchical approach at the regional and sub-regional level.

Spatial patterns of real estate development are used as an indicator to describe the evolution and expansion of built-up areas of individual urban centres and to determine the centrality of the regional urban structure. The context - constituted by the actors, rules and external factors that play a central role in local development processes - is studied to offer a more comprehensive understanding of the drivers that influence urban growth patterns. Based on these findings, the implications of land and real development on the morphological regional urban structures in the region of Perak are explained. Ultimately, the definition of the regional urban configuration of the 'Perak Diamond' is constructed and verified through a multidisciplinary approach, bundling quantitative and qualitative analytical methods.

Referring to the historical urbanization processes of the urban centres in the study area, it is observed that a pattern of monocentric growth over the last twenty-five years is undeniable. While the population of small centres grows relatively fast, the absolute population growth remains the highest in larger centres. This is reflected by the increasing 'weight' of Ipoh in the regional urban system. This undermines one of the foundations that characterize a polycentric structure, namely a balanced set of equally sized cities.

Considering the locations of construction activity, it was found that they mainly concentrate around two centres, namely Ipoh and Lumut-Sitiawan. This is also reflected in the land- and housing prices, as these are the highest in these areas. A spatial analysis of development applications indicates that the number of projects in Lumut-Sitiawan grew relatively fast over the years, indicating the popularity of this location for developers, driven by locational advantages, such as the construction of the Westcoast Expressway. From a regional perspective, this suggests the emergence of a second centre in the regional urban system.

However, the efficiency of the regional urban structure is determined on a lower spatial scale level. A consideration of the expansion of the built-up areas of individual centres suggests that the efficiency of urban form is place-dependent. In fact, the observed development patterns show large differences in the formation of urban areas. Analyses of historical patterns of built-up area expansion indicate a typical sprawled urban form in Lumut-Sitiawan, characterized by low-density peripheral development patterns alongside the roads and township projects on isolated locations. In fact, the largest construction project in the study area is located on a considerable distance of the existing urban area of Lumut-Sitiawan, demanding significant investments in infrastructure. Such projects negatively impact the efficiency of urban form. For these reasons it is found that Lumut-Sitiawan is unlikely to gain in urban mass, undermining its potential to develop as a secondary centre with a regional function.

This is in contradiction to the situation in Ipoh, where infill developments, characterized by high-density building construction within the existing boundaries of the city, contributing to the

compactness of the urban form, which allows for enhancing efficiency and mass. In fact, considering recent development patterns, Ipoh is the only centre that enhances efficient development patterns. By gaining in mass, the centrality of Ipoh in the regional urban system strengthens, supporting monocentric growth.

The lack of compact centres in the study area and the presence of scattered developments patterns and low-density sprawl undermines an important condition to enhance an *efficient* polycentric structure. Considering the development context, this situation will be difficult to change, as physical development is not steered by adequate planning. Although physical plans exist both the regional as on the local level, these plans can easily be adjusted because of loopholes in the planning system. This leads to a situation in which developers continuously transform agricultural land to construction land, resulting in autonomous developments that are not in line with the original plans. Local authorities stimulate these processes, as they allow re-zoning to achieve their financial ambitions. Besides this, there is a lack of control and coordination from the higher authorities. Local authorities operate as autonomous actors, who don't consider the role of their city in the larger regional system.

To conclude, the research shows the difficulty to define the morphological regional urban structure of the 'Perak Diamond', as the different scenarios do not seem to exclude each other. In fact, the regional urban structure of the Perak Diamond can best be described as monocentric, with characteristics of archipelago development around Lumut-Sitiawan and characteristics of corridor development patterns alongside the main roads.

Ultimately, the potential to form a polycentric regional structure, from a morphological perspective, is highly doubted, because of little control and coordination by (state) governments, the absence of adequate land management and loopholes in the planning system, which stimulate autonomous developments and makes it is difficult to steer urban development towards a polycentric scenario.

The limitations of the research, anticipated in the main body of the investigation, are mainly associated with a lack of appropriate data at the lowest locational level. In fact, information on recent construction patterns is hardly identifiable. This issue is overcome through the use of secondary resources and intensive fieldwork, to identify locations of current building construction. By doing so, it might be the case that some projects have been overlooked. On the positive note, the abundance of data at the mukim-level allowed to merge different datasets according to the authors' definitions of urban areas. Another major issue is that some data sources are available but cannot be shared for confidential reasons. The difficulty to access data can also be related to the unresponsiveness of people. The involvement of local experts or researchers would allow overcoming such problems.

Even though this research significantly contributes to the understanding of the urban configuration in the Perak Diamond, the suggestion for future studies is to enrich the investigation by (i) a more in-depth analysis of the spatial differentiation of housing- and land prices on a lower scale level, (ii) investigating local real estate markets from a demand perspective, and (iii) investigating the possibilities to enhance polycentric development by explicitly identifying bottlenecks.

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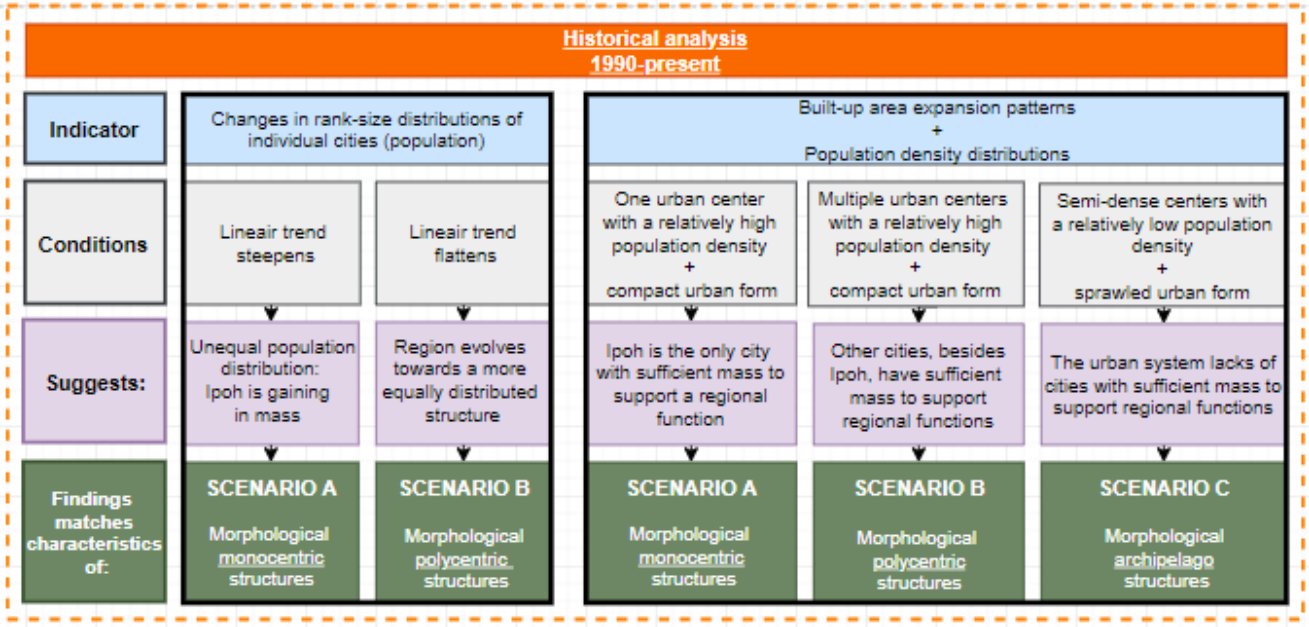
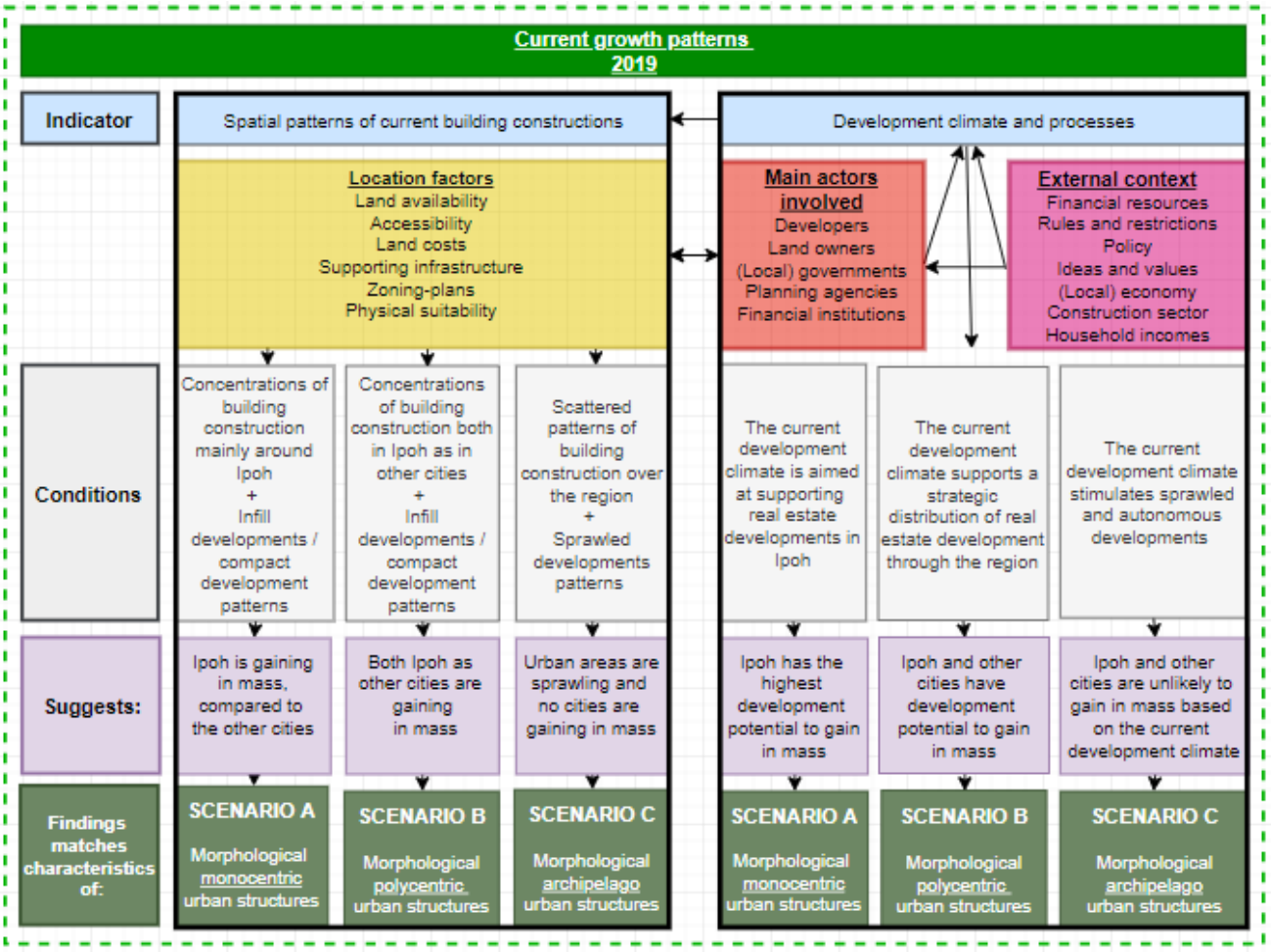
Interviewees

Company / (governmental) agencies	Description	Person / ***Function***	Type of information / Topics
LPHP Perak Housing and Property Board	LPHP is a governmental agency responsible for the regulation, promotion, coordination, facilitation and implementation of housing- and property development in Perak, mainly focussed on public and affordable housing. Directly responsible for the implementation of housing schemes as part of the State plans, through joint ventures with local developers.	Mohamad Sabri Bin Ahmad ***Deputy Chief Executive Officer***	Development policies. Processes. Implementation and status of affordable housing schemes (Perakku Housing Programme) Joint-Ventures *Data:* Building permits APDL's
PTG Perak Land and Mineral Director Office Perak	Land administration and management organisation. As one of the main frontline agencies of the state government, PTG Perak has a role and responsibility in leading the improvement of land administration matters throughout Perak.	Muhammad Nazri ***Director of the Land Development Unit***	Zoning-plans. Changing land-use status. Legal procedures. Tax-systems. Joint-Ventures.
IMMANUEL Construction & Development	Private developer and constructor in Sri Manjung.	Ricky Yu ***Director***	Trends in the construction industry. Building permissions. Changing land-use status. Location factors Lumut-Sitiawan
Setia Awan Holdings Sdn. Bhd.	Private developer, responsible for the Seti Awan Township project. The largest development in the study area, located on an inter-urban location.	Hafizzi Ramat ***Manager***	Location factors of the township project. Financing. Joint-Ventures. Development potential other locations.
FELCRA Berhad *(not recorded)* Federal Land Consolidation and Rehabilitation Authority	Corporate organisation wholly owned by the Malaysian Government, under the Ministry of Finance, with the objective to develop rural areas.	Yusra Narais ***General Manager***	Location factors for the inter-urban development project close to Teluk Intan / drivers behind the project
KIJAYA Real Estate	A private developer in Teluk Intan, responsible for the 'Richmond Residences' project.	Man Mei Ling ***Manager***	Drivers behind private projects. Location factors. Land ownership.

Appendix

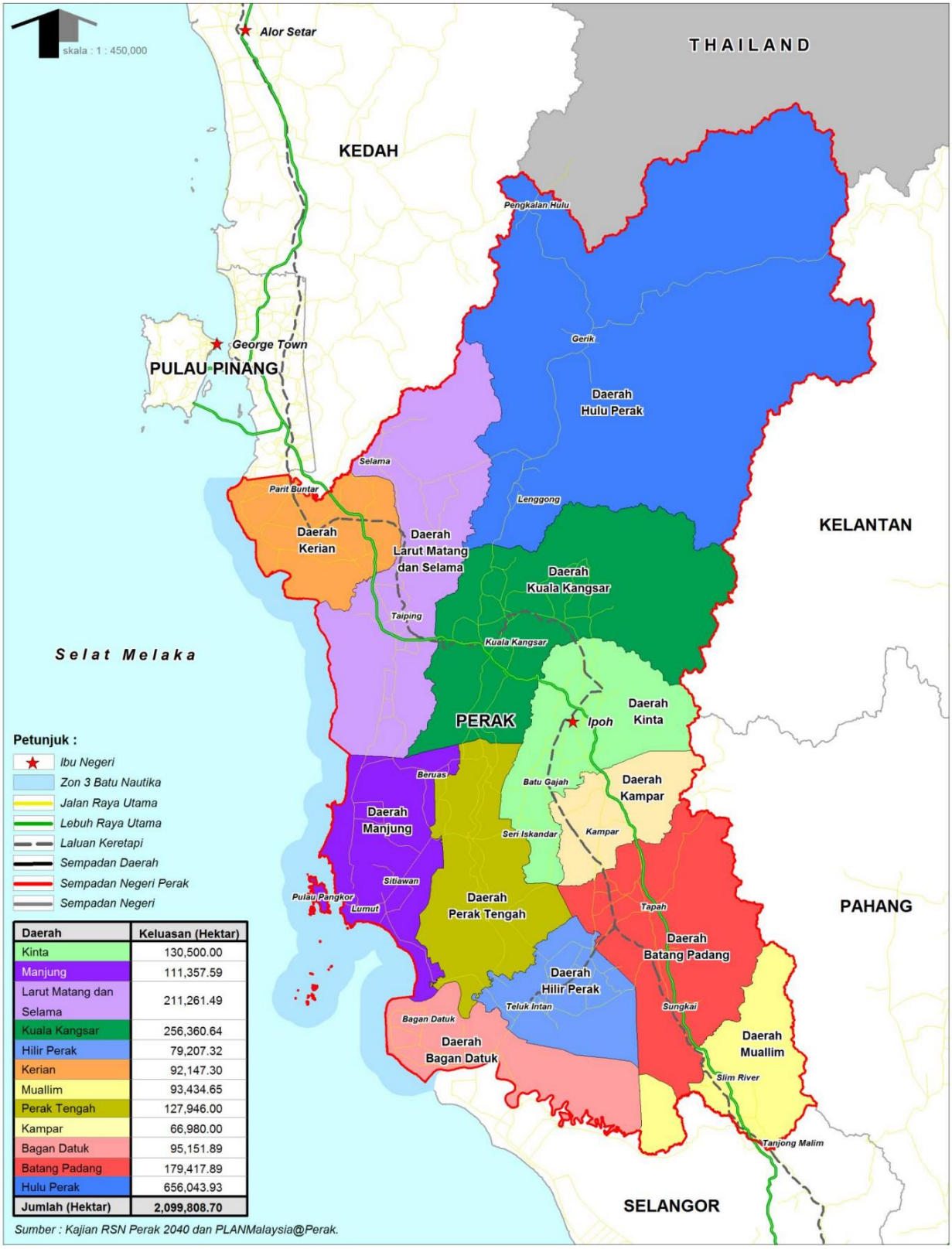
Appendix 1: Workflow model





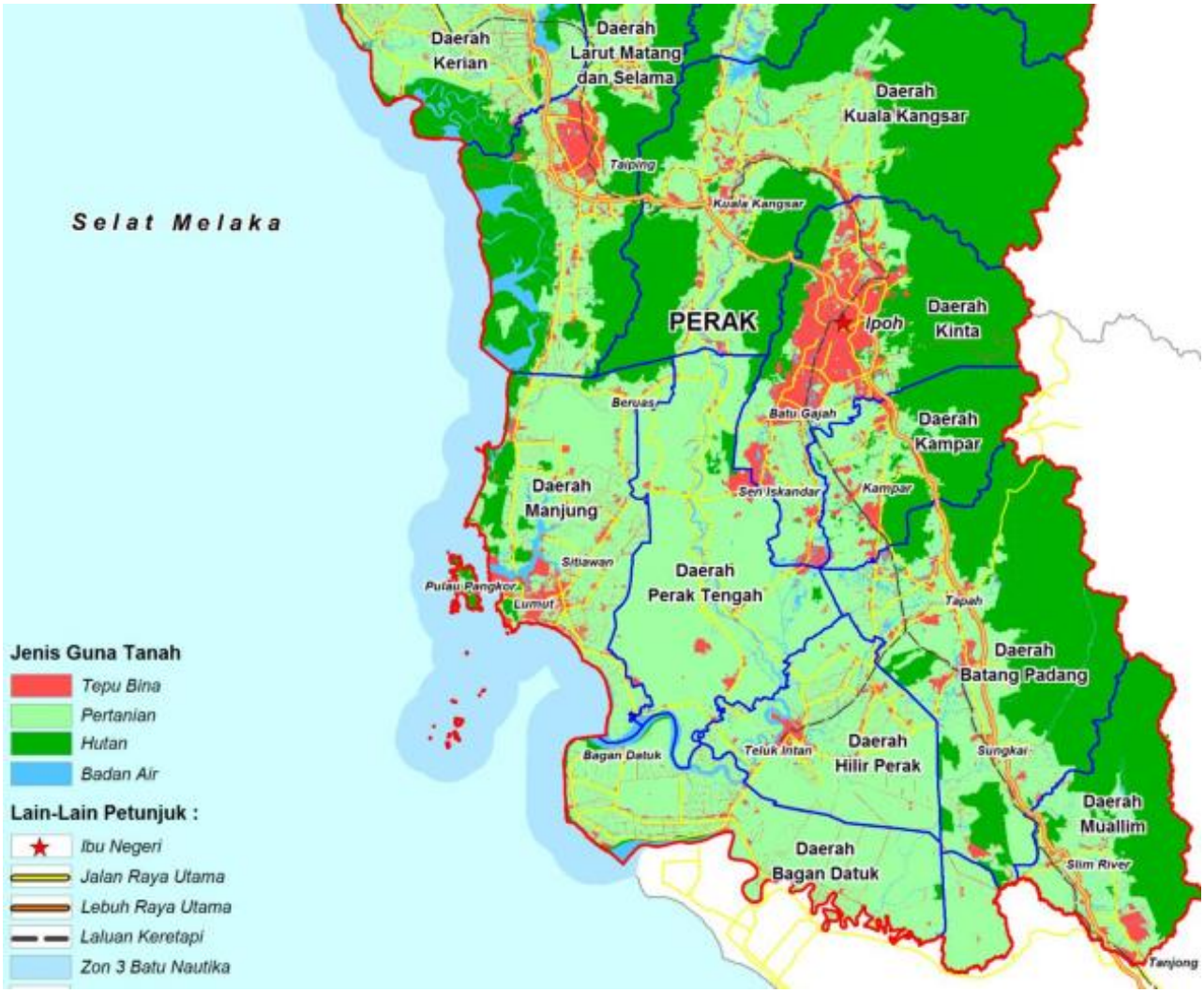
Appendix 2: Maps of Perak and the study area

2.1 Administrative districts and their absolute size (in hectares). *Source: DRSNP2040 (2018)*



Daerah	Keluasan (Hektar)
Kinta	130,500.00
Manjung	111,357.59
Larut Matang dan Selama	211,261.49
Kuala Kangsar	256,360.64
Hilir Perak	79,207.32
Kerian	92,147.30
Muallim	93,434.65
Perak Tengah	127,946.00
Kampar	66,980.00
Bagan Datuk	95,151.89
Batang Padang	179,417.89
Hulu Perak	656,043.93
Jumlah (Hektar)	**2,099,808.70**

2.2 Land use per district. *Source: DRSNP 2040 (2018).*

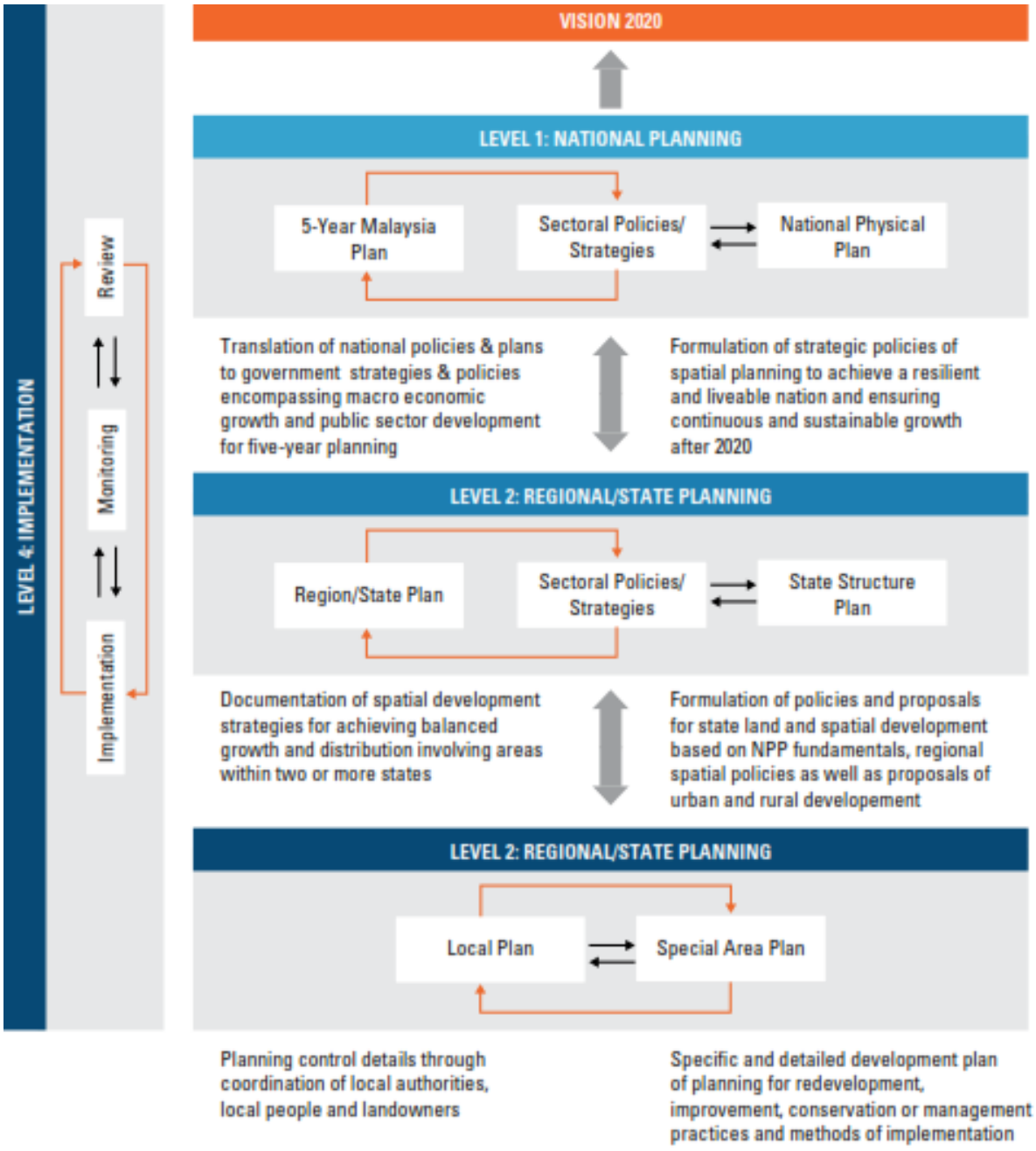


** the red areas indicate the built-up land; the darker green indicates forestry land use; the light green indicates agricultural land.*

Appendix 3: Defined urban areas and corresponding mukims

Defined 'urban area':	*Exists of town(s):*	*Located in mukim(s):*
Ipoh	Ipoh, Chemor	Ulu Kinta, Sungai Raia
Taiping-Kamunting	Taiping, Kamunting	Asam Kumbang, Kamunting, Pengkalan Aor, Tupai
Manjung	Lumut, Sitiawan, Seri Manjung, Ayer Tawar	Lumut, Sitiawan
Teluk Intan	Teluk Intan	Durian Sebatang
Bidor	Bidor	Bidor
Tapah	Tapah, Tapah Road	Batang Padang
Pantai Remis	Pantai Remis	Pengkalan Baharu
Kampar	Kampar	Kampar
Seri Iskandar	Seri Iskandar, Bota	Bota
Batu Gajah	Batu Gajah, Pusing	Sungai Terap
Gopeng	Gopeng	Teja
Sungai Siput	Sungai Siput	Sungai Siput
Kuala Kangsar	Kuala Kangsar	Kota Lama Kiri, Saiong

Appendix 4: Physical development planning framework



Source: Khazanah Research Institute, 2019, p. 155.

Appendix 5: Multi-temporal analysis of built-up area expansion

Batu Kurau

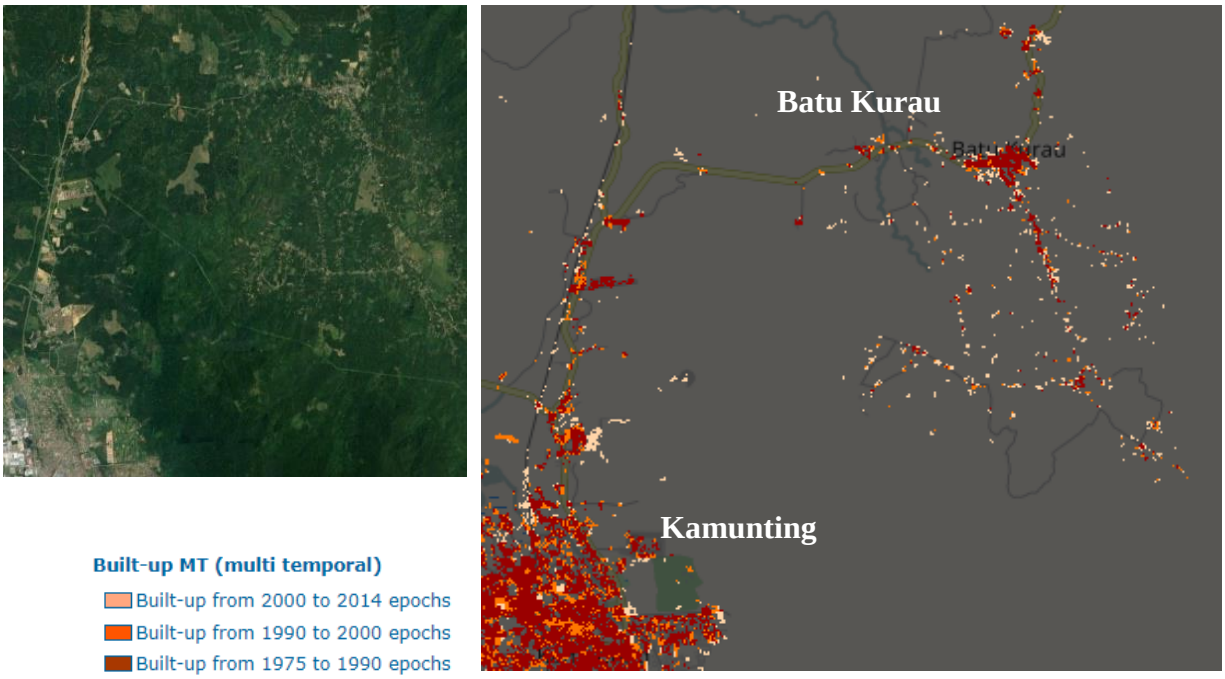


Figure X: Multi-temporal information layer of built-up area expansion in Batu Kurau. *Source: Google Earth 2019 (left) and the online visualisation-tool of the European Commission (right), based on GHSL data © European Union, 1995-2019*

Bidor and Tapah

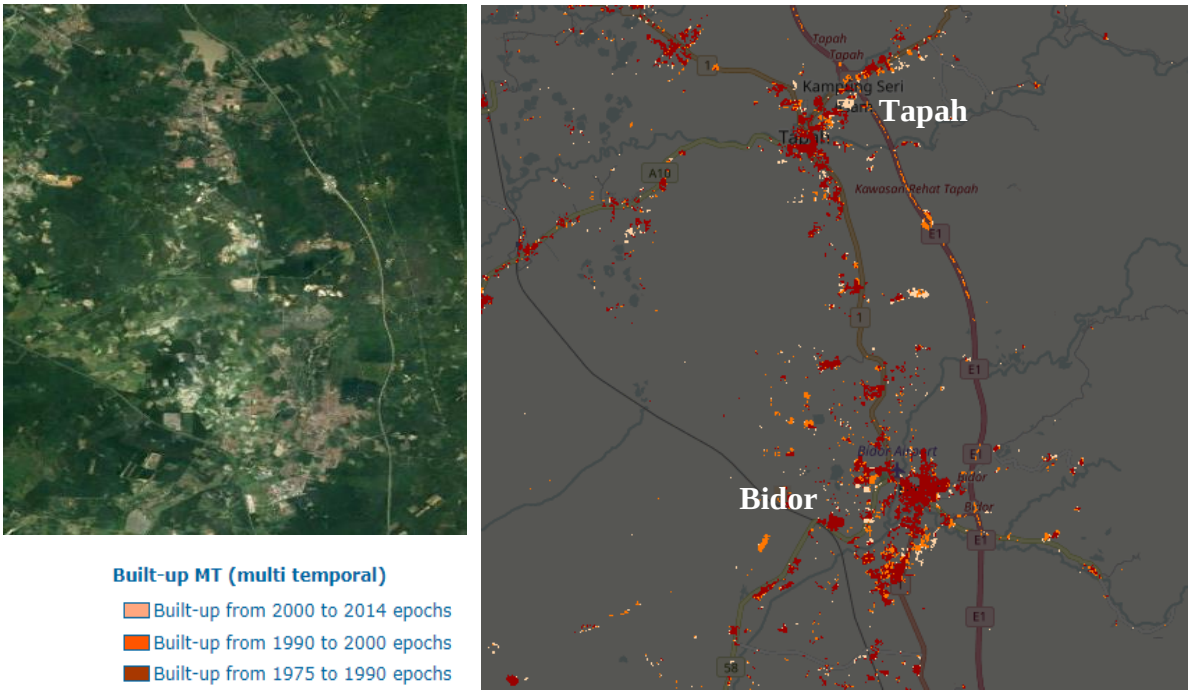


Figure X: Multi-temporal information layer of built-up area expansion in Tapah and Bidor. *Source: Google Earth 2019 (left) and the online visualisation-tool of the European Commission (right), based on GHSL data © European Union, 1995-2019*

Seri Iskandar and Kampar

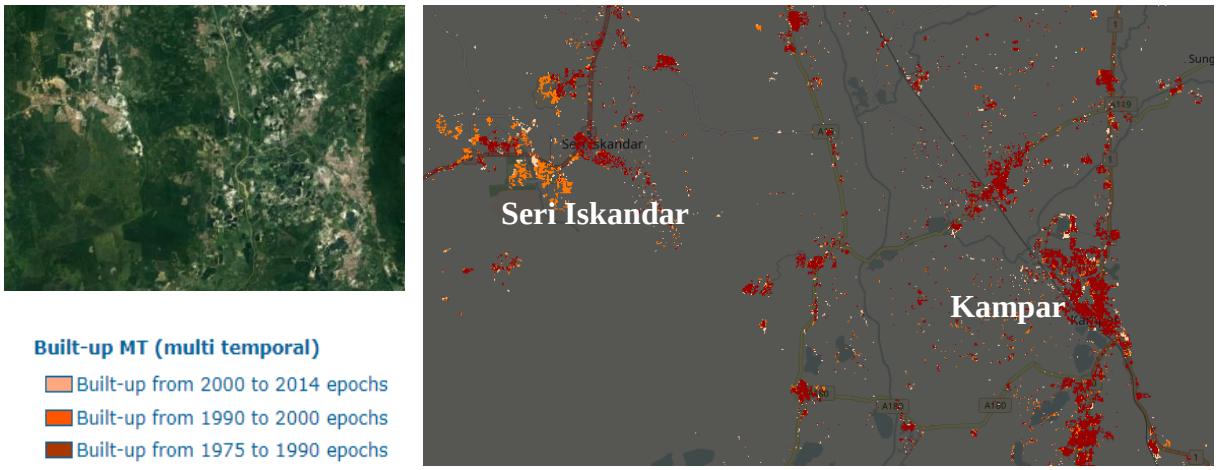


Figure X: Multi-temporal information layer of built-up area expansion in Seri Iskandar and Kapar. *Source: Google Earth 2019 (left) and the online visualisation-tool of the European Commission (right), based on GHSL data © European Union, 1995-2019*

Batu Gajah and Gopeng

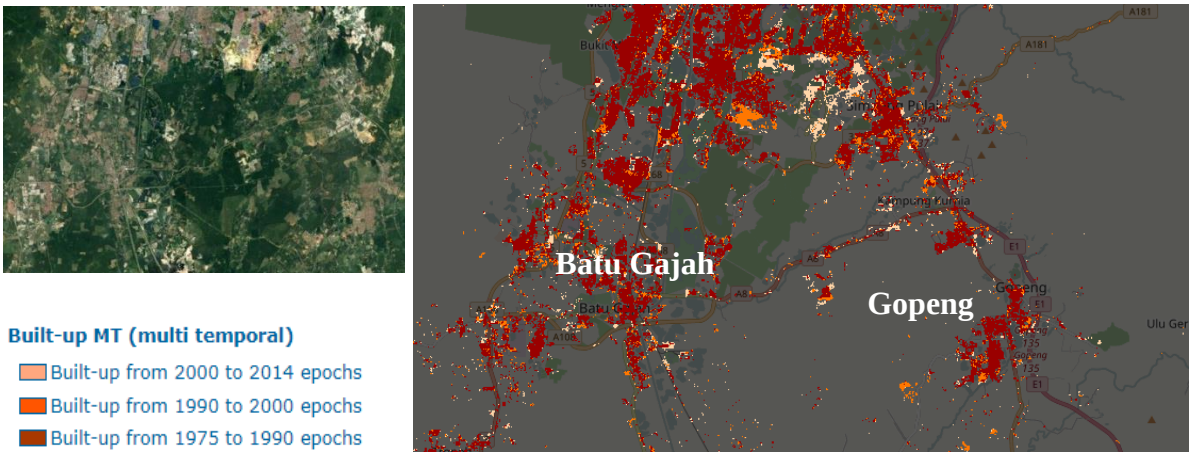
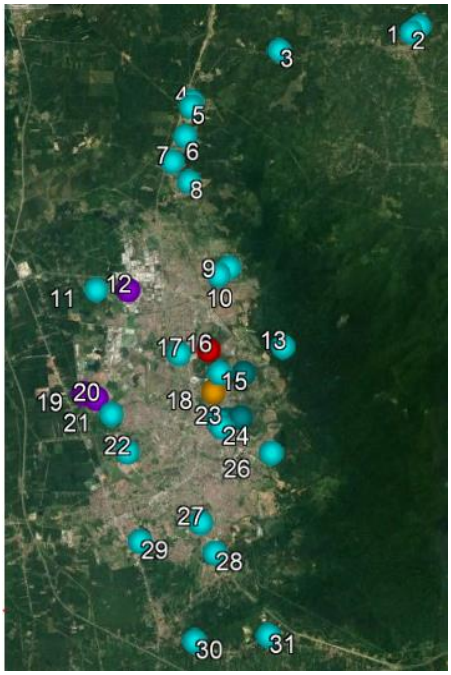


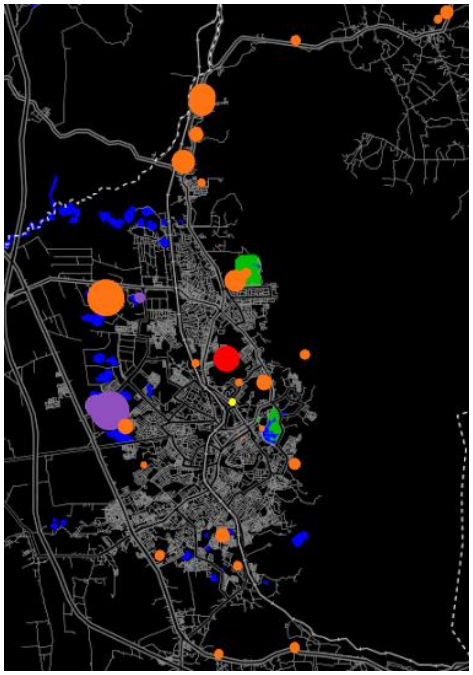
Figure X: Multi-temporal information layer of built-up area expansion in Batu Gajah and Gopeng. *Source: Google Earth 2019 (left) and the online visualisation-tool of the European Commission (right), based on GHSL data © European Union, 1995-2019*

Appendix 6: Fieldwork observations: details of projects per urban area

The details for each project are gathered by multiple resources; fieldwork observations, secondary resources or direct via developers or municipalities. The size in hectare is measured in Google Earth (2019). The red numbers indicate scenario's in which the exact number of units / hectares could not be found and are therefore estimations. The projects highlighted in yellow are affordable housing projects (mostly PPA1M of PR1MA).

Taiping-Kamunting



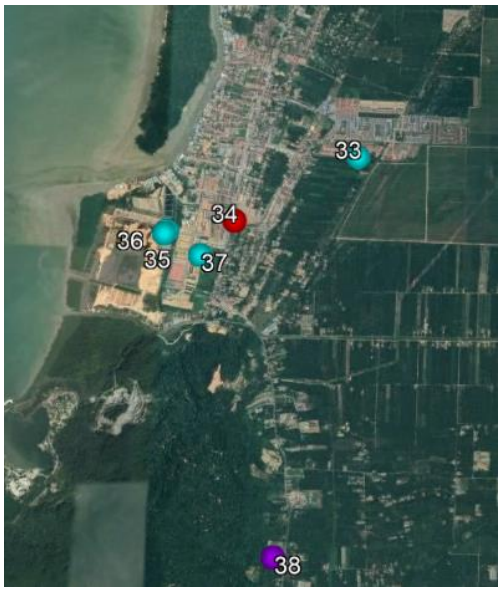


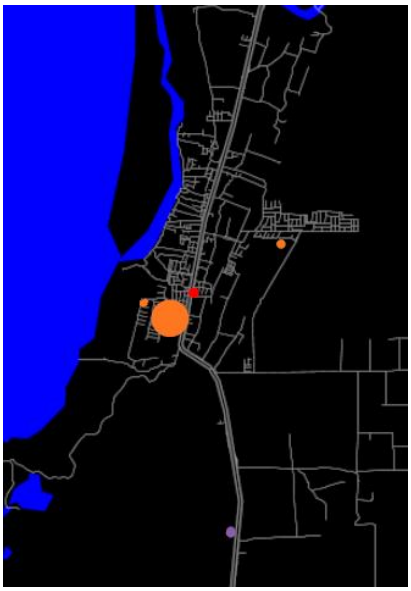
Total nr of projects	**31**
Construction phase	22
Completed	9
Total nr of units	3185
Of which residential	2907
Construction phase	1892
Completed	1293
Average units per project	114
when townships excluded	-
Total hectare	247
Resi. + Towns. Hectare	162

Typology	
Residential	26
Industrial	3
Commercial	1
Mixed-use	1
Township	0
Other	0

Nr	Name project	Typolog	Hectare	Units	Developer	Phase
1	-	Residen	5	40	-	Completed
2	Taman Kurau Sentosa	Residen	2	30	Seng Hong Enterprise Sdn. Bhd.	Construction
3	-	Residen	3	81	-	Construction
4	-	Residen	20	441	Handal Damai Plantation Sdn. Bhd.	Construction
5	-	Residen	17	100	-	Completed
6	-	Residen	6	100	-	Construction
7	Taman Larah Aman	Residen	16	59	-	Construction
8	-	Residen	2	150	-	Construction
9	-	Residen	14	273	KL Teh Land & Development Sdn Bhd	Construction
10	Jana Harmoni	Residen	7	88	KL Teh Land & Development Sdn Bhd	Construction
11	PR1MA@Kamunting	Residen	25	525	Sunsetvilla	Completed
12	-	Industri	3,3	1	Lih Mei industrial Sdn. Bhd.	Construction
13	Taman Suria Aman	Residen	5,2	76	Asiabina / Tulus Aswan Sdn. Bhd.	Construction
14	Vistana Hill	Residen	7	50	-	Construction
15	Sunset Villa Taiping	Residen	1,8	96	Sunset Villa Sdn Bhd	Construction
16	Taiping Heights	Mixed u	20	190	Sycal Ventures Berhad	Construction
17	-	Residen	2	50	-	Construction
18	Istana Larut Business Park	Commer	1,5	45	Asiabina holdings Sdn. Bhd.	Completed
19	-	Industri	14	2	-	Construction
20	-	Industri	45	10	-	Construction
21	Aulong Maju	Residen	7	220	Teh & Teh Development Sdn. Bhd.	Completed
22	-	Residen	1,3	-	Sunrise Fairway Sdn. Bhd.	Construction
23	Renovation project	Residen	0,1	2	Cagar Telus Sdn Bhd	Construction
24	-	Residen	0,15	-	Sunset Villa Sdn Bhd	Construction
25	-	Residen	1	-	KL Teh Land & Development Sdn Bhd	Construction
26	Crystal Creek Resort home	Residen	4	300	Crystal Prestige Sdn Bhd	Completed
27	Taman Pengkalan Utama	Residen	6	143	Insan Dinamik Sdn Bhd	Construction
28	Taman Aur Damai	Residen	2,5	21	-	Completed
29	Taman Aor Permai	Residen	3	18	Rumahku Amanjaya	Completed
30	Taman Gantang Murni	Residen	2,5	24	Bullion Income Sdn. Bhd.	Completed
31	Taman Gantang Setia	Residen	3	50	-	Construction

Pantai Remis



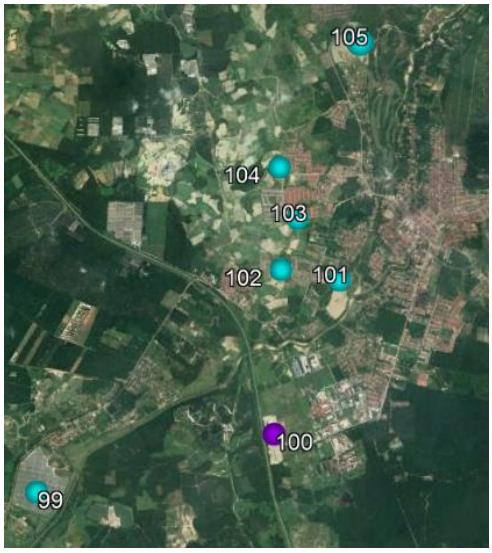


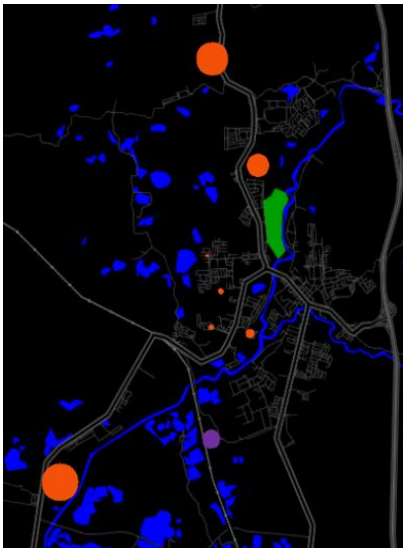
Total nr of projects	**7**
Construction phase	5
Completed	2
Total nr of units	621
Of which residential	570
Construction phase	591
Completed	30
Average units per project	89
when townships excluded	-
Total hectare	30
Res. + Towns. Hectare	29

Typology	
Residential	5
Industrial	1
Commercial	0
Mixed-use	1
Township	0
Other	0

Nr	Name project	Typology	Hectare	Units	Developer	Phase
32	Sungai Emas Residency	Residential	1,5	41	Kin Chai Development Sdn Bhd	Construction
33	-	Residential	1,2	20	-	Completed
34	-	Mixed	0,8	50	-	Construction
35	Pantai Saujana	Residential	0,4	10	Mylander Development Sdn Bhd	Completed
36	SG Batu	Residential	0,4	8	Great home development	Construction
37	PPA1M - Taman Pantai Dar	Residential	25	491	AsiaBina & Kartika Saujana Sdn Bhd	Construction
38	-	Industrial	0,7	1	-	Construction

Bidor



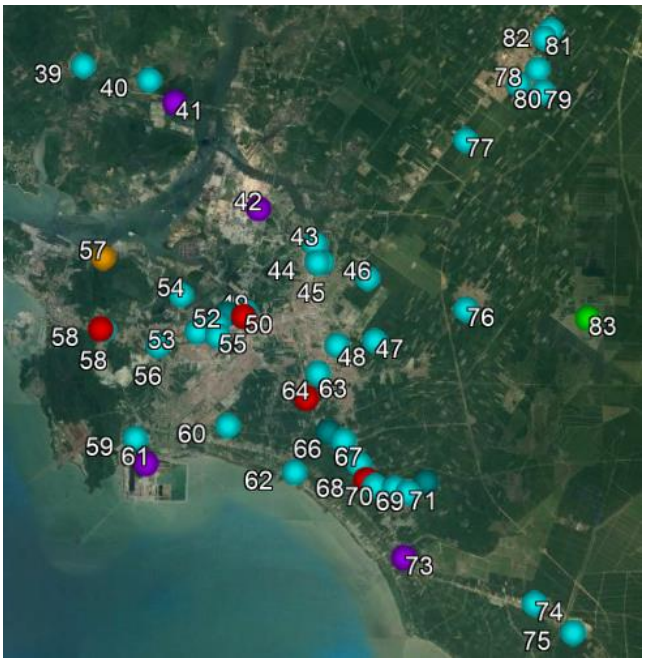


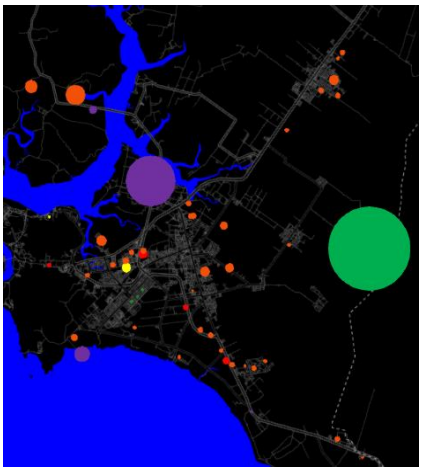
Total nr of projects	**7**
Construction phase	6
Completed	1
Total nr of units	585
Of which residential	584
Construction phase	584
Completed	1
Average units per project	84
when townships excluded	-
Total hectare	32
Res. + Towns. Hectare	24

Typology	
Residential	6
Industrial	1
Commercial	0
Mixed-use	0
Township	0
Other	0

Nr	Name project	Typology	Hectare	Units	Developer	Phase
99	PR1MA @ Bidor	Residential	12	397	-	Construction
100	-	Industrial	8	1	-	Completed
101	Bidor damansara	Residential	2	36	-	Construction
102	-	Residential	0,8	20	Dynamic uni-max sdm bhd	Construction
103	Taman Bidor Putera	Residential	0,8	28	Mutual Style Sdn Bhd	Construction
104	Taman Permai	Residential	0,3	16	Cyboland	Construction
105	Menuju Kejayaan	Residential	8	87	-	Construction

Lumut-Sitiawan





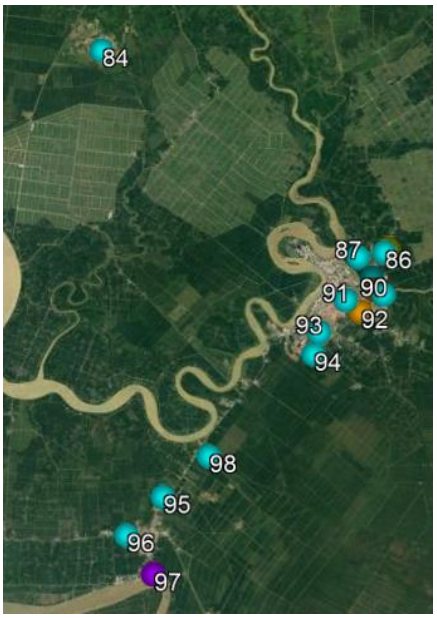
Total nr of projects	**44**
Construction phase	23
Completed	21
Total nr of units	15488
Of which residential	14540
Construction phase	13383
Completed	2105
Average units per project	369
when townships excluded	121
Total hectare	701
Residential + Towns. hectare	518

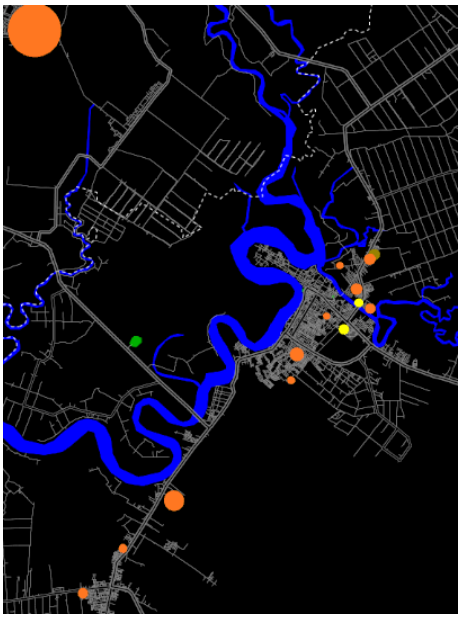
Typology	
Residential	34
Industrial	4
Commercial	2
Mixed-use	4
Township	1
Other	0

Nr	Name project	Typology	Hectare	Units	Developer	Phase
39	-	Residential	10	277	Sycal Properties Sdn Bhd	Construction
40	PR1MA @ Lumut	Residential	24	623	-	Construction
41	-	Industrial	-	-	-	-
42	-	Industrial	150	-	-	Construction
43	Taman botanika residence	Residential	2	125	Blue Print Properties	Construction
44	Majlis Perbandaran Manjung	Residential	2	40	-	Completed
45	-	Residential	2,4	25	-	Completed
46	Taman Mulia	Residential	4	140	Setia Awan group	Completed
47	Taman selamat indah	Residential	5	87	Wonderful legend sdn bhd	Construction
48	Taman Bunga Raya 1	Residential	6	242	-	Completed
49	-	Residential	2,5	500	-	Construction
50	Taman Sejati	Mixed use	5	100	YNH Property	Construction
51	Candangan Membina	Residential	1,8	58	-	Construction
52	Seksyen 2	Residential	2,6	105	YNH Property	Construction
53	Pangsapuri Semudera 1	Residential	1,8	720	YNH Property	Completed
54	Taman Desa Manjung	Residential	6,7	201	YNH Property	Completed
55	PPMP2	Commercial	5,5	90	YNH Property	Completed
56	-	Residential	1,5	50	-	Construction
57	Ramada lumut resort	Commercial	0,6	532	KB Group Sdn Bhd	Construction
58	-	Mixed use	1,4	40	-	Construction
59	Taman Seri Rubah	Residential	3	100	-	Completed
60	Manjung Residen (PPA1M)	Residential	1	27	Konsortium BKB sdn bhd	Completed
61	-	Industrial	15	-	-	Construction
62	-	Residential	1	31	-	Construction
63	Taman Jati 2	Residential	0,5	30	Blue Print Properties	Completed
64	Taman Permatang Maju 2	Mixed use	2	85	Blue Print Properties	Completed
65	Taman Permatang Permai	Residential	2	50	Blue Print Properties	Construction
66	Taman Lekir Damai	Residential	2	60	Blue Print Properties	Completed
67	Taman Sri Lekir 2	Residential	1,3	25	Blue Print Properties	Completed
68	Taman Lekir Maju	Mixed use	2,8	100	-	Completed
69	Taman Lekir Barkari	Residential	2	50	-	Completed
70	Taman Lekir Bestari 2	Residential	0,7	16	Blue Print Properties	Completed

71	Taman Er Leki	Residential	1,7	70	-	Completed
72	Taman Lekir Aman	Residential	1	20	Blue Print Properties	Construction
73	-	Industrial	0,5	1	-	Completed
74	Taman Mohd Wazir	Residential	2	30	Great Home Development	Completed
75	-	Residential	0,5	10	-	Construction
76	Taman Gurney Jaya 2	Residential	1	28	Ost Development Sdn Bhd	Completed
77	-	Residential	1,3	20	Sime Darby	Construction
78	Akan Dibuka	Residential	2	50	Hartanakatur sdn bhd	Construction
79	-	Residential	2	79	Free Spirit Innovations	Construction
80	Taman ayer tawar jaya 2	Residential	6	100	-	Construction
81	Taman Emas	Residential	1	25	-	Completed
82	Akan Dibuka	Residential	-	26	Ong keh wah and sons	Construction
83	BBSAP (including PR1MA @ Sitiawan)	Township	414	10500	Sitia Awan Holdings Sdn Bhd	Construction

Teluk Intan



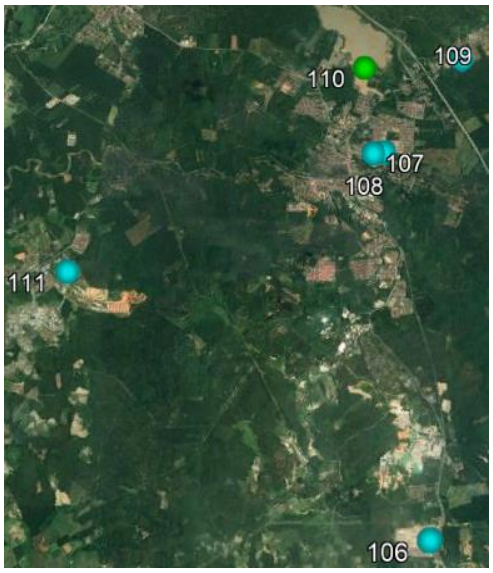


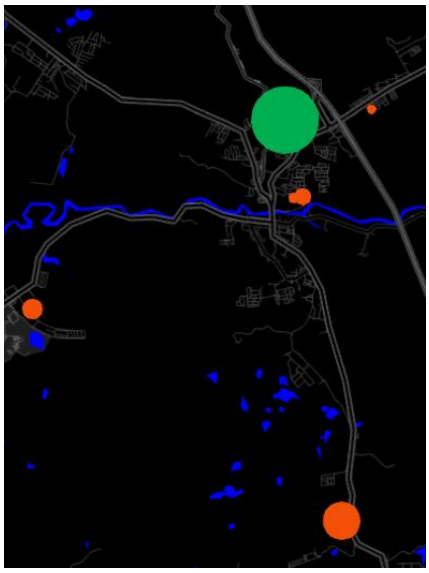
Total nr of projects	**15**
Construction phase	4
Completed	11
Total nr of units	1209
Of which residential	1207
Construction phase	250
Completed	959
Average units per project	93
when townships excluded	-
Total hectare	75
Resi. + Towns. hectare	64

Typology	
Residential	11
Industrial	1
Commercial	2
Mixed-use	0
Township	0
Other	1

Nr	Name project	Typology	Hectare	Units	Developer	Phase
84	Taman Felcra Jaya fasa 2	Residential	32	710	Felcra Berhad	Completed
85	Smk kampung bahagia	School	3	-	-	Completed
86	Taman Ceria	Residential	3	70	-	Completed
87	Taman intan bahagia 2	Residential	1,3	28	Updic Enterprise Sdn Bhd	Completed
88	-	Residential	3,2	60	-	Construction
89	-	Commercial	1,8	1	-	Completed
90	Richmond residence	Residential	2,5	37	Kijaya Real Estate	Completed
91	Taman Intan Aman	Residential	1,2	16	TBT development	Completed
92	Office building	Commercial	2,5	1	-	Completed
93	Taman darul ridzuan	Residential	4,7	40	Rumahku Amanjaya	Construction
94	-	Residential	1,5	12	-	Completed
95	Melintang Utama	Residential	1,8	20	-	Completed
96	-	Residential	2,5	64	-	Completed
97	-	Industrial	4	-	-	Construction
98	-	Residential	10	150	-	Construction

Tapah



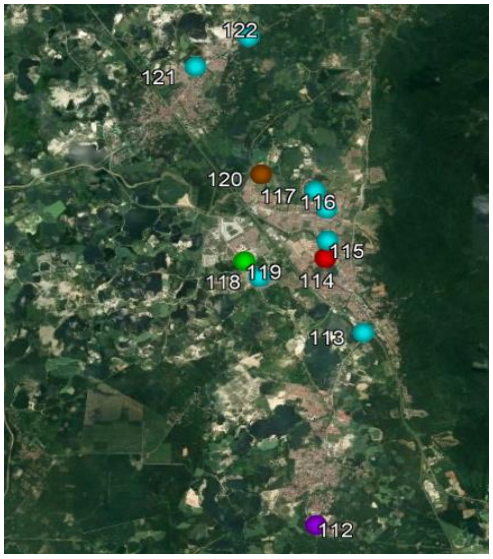


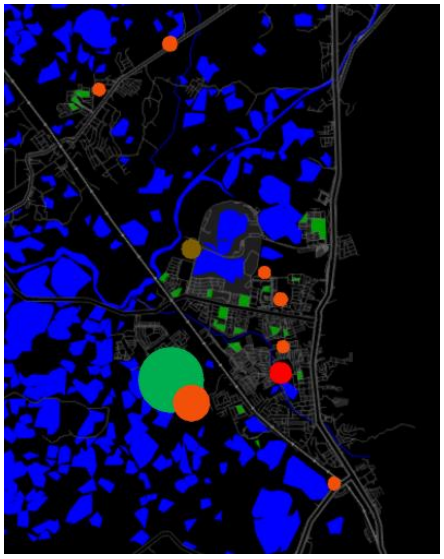
Total nr of projects	**6**
Construction phase	4
Completed	2
Total nr of units	2901
Of which residential	2901
Construction phase	2304
Completed	597
Average units per project	484
when townships excluded	180
Total hectare	121
Resi. + towns. Hectare	121

Typology	
Residential	5
Industrial	0
Commercial	0
Mixed-use	0
Township	1
Other	0

Nr	Name project	Typology	Hectare	Units	Developer	Phase
106	PR1MA @ Tapah	Residential	25	647	-	Completed
107	-	Residential	5	91	Kanglian Developments sdn bhd	Construction
108	Taman bunga raya	Residential	2	50	-	Completed
109	-	Residential	1,5	24	-	Construction
110	Bandar Transit Tapah	Township	80	2000	Tapah Estate	Construction
111	Taman HeliConia	Residential	7,5	89	-	Construction

Kampar



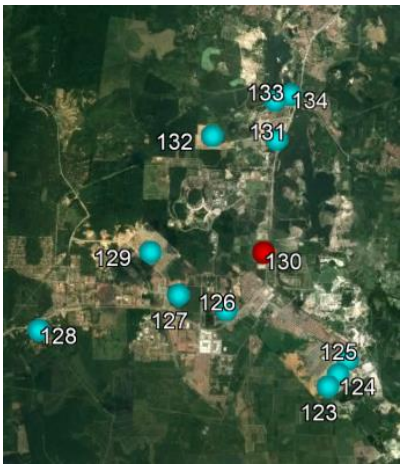


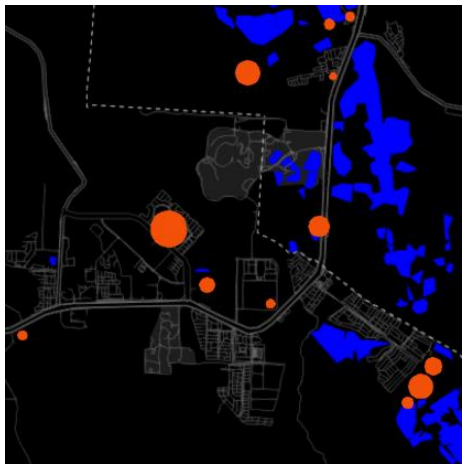
Total nr of projects	**11**
Construction phase	9
Completed	2
Total nr of units	3380
Of which residential	3306
Construction phase	2696
Completed	684
Average units per project	307
when townships excluded	221
Total hectare	127
Resi. + Towns. Hectare	112

Typology	
Residential	7
Industrial	1
Commercial	0
Mixed-use	1
Township	1
Other	1

Nr	Name project	Typology	Hectare	Units	Developer	Phase
112	-	Industrial	0,8	1	-	Construction
113	Lakeview Kampar	Residential	3	52	UM Land	Construction
114	Taman Damai@ kampar	Mixed use	8	72	-	Construction
115	Kolam tadahan	Residential	3	75	-	Completed
116	-	Residential	3,5	200	-	Construction
117	Lake Campus Condominium	Residential	3	1050	Magnibz Development sdn bhd	Construction
118	PR1MA @ Kampar	Residential	22	609	-	Completed
119	Kampar Putra	Township	70	1166	Scanwolf Property Development	Construction
120	Utar Hospital	Hospital	6,5	1	-	Construction
121	-	Residential	3	54	-	Construction
122	Bella Malim Nawar	Residential	4	100	Cerdik sempurna	Construction

Seri Iskandar



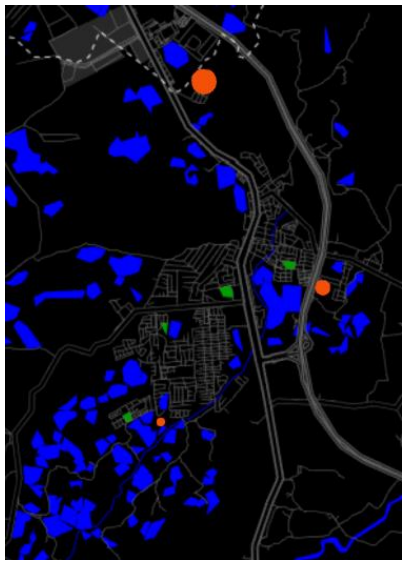


Total nr of projects	**12**
Construction phase	8
Completed	4
Total nr of units	3474
Of which residential	3474
Construction phase	2534
Completed	940
Average units per project	316
when townships excluded	-
Total hectare	171
Resi + Town. Hectare	171

Typology	
Residential	12
Industrial	0
Commercial	0
Mixed-use	0
Township	0
Other	0

Nr	Name project	Typology	Hectare	Units	Developer	Phase
123	-	Residential	6	86	Agro mod instustries sdn bhd	Construction
124	-	Residential	25	-	-	Construction
125	PPR Seri Iskandar	Residential	13	120	-	Completed
126	-	Residential	4	50	-	Construction
127	-	Residential	10	1100	-	Construction
128	-	Residential	4	112	LPHP	Construction
129	Puncak Iskandar	Residential	54	600	-	Completed
130	Lestari IUS	Residential	18	595	-	Construction
131	-	Residential	2,5	49	Tetuan esteem pyramid sdn bhd	Construction
132	UNI parkland	Residential	25	542	-	Construction
133	-	Residential	5	100	Taman Tronoh Management	Completed
134	-	Residential	4	120	-	Completed

Gopeng



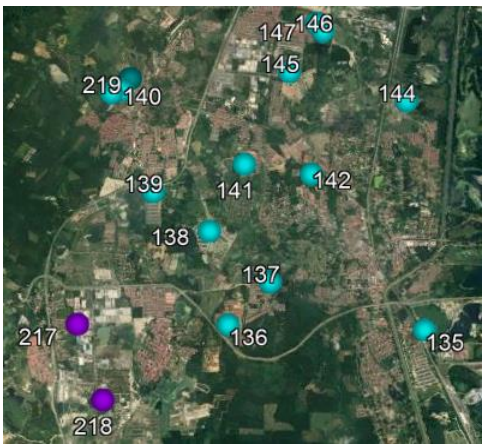
Total nr of projects	**3**
Construction phase	3
Completed	0
Total nr of units	512
Of which residential	512
Construction phase	512
Completed	0
Average units per project	170
when townships excluded	-
Total hectare	18
Resi. + Towns. Hectare	18

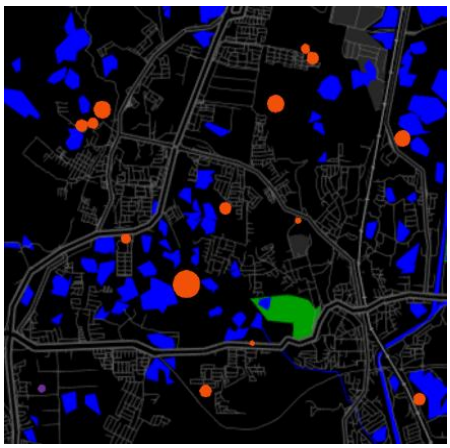
Typology	
Residential	3
Industrial	0
Commercial	0
Mixed-use	0
Township	0
Other	0

Nr	Name project	Typology	Hectare	Units	Developer	Phase
148	Gopeng lawan kuda	Residential	1,5	20	-	Construction
149	Shangri la country homes	Residential	4,5	116	Pinar Mewah	Construction
150	PR1MA @ SG	Residential	12	376	-	Construction

Batuh Gajah (and Pusing)

Total nr of projects	**16**
Construction phase	13
Completed	3
Total nr of units	1737
Of which residential	1735
Construction phase	1624
Completed	113
Average units per project	109
when townships excluded	-
Total hectare	61
Resi. + Towns. Hectare	59





Typology	
Residential	14
Industrial	2
Commercial	0
Mixed-use	0
Township	0
Other	0

Nr	Name project	Typology	Hectare	Units	Developer	Phase
135	-	Residential	3	124	Silverland capital	Construction
136	-	Residential	3	50	Muda awan sdn	Construction
137	-	Residential	0,6	10	-	Completed
138	Benban Ipoh-Lumut highway res.	Residential	15	165	JRD Development	Construction
139	-	Residential	2	746	-	Construction
140	Taman pusing delima	Residential	2,3	70	Amen Peangi sdn bhd	Construction
141	Cadangan membina	Residential	3	68	Sri anika entreprise	Construction
142	-	Residential	0,8	20	-	Construction
143	Taman pusing delima	Residential	6	61	Goldman engineering & construction	Completed
144	Lakeview Residence	Residential	5	90	KPM development	Construction
145	Metro maya @ batu gajah	Residential	6	139	Spnb aspirasi sdn bhd	Construction
146	-	Residential	3	54	Builders & contractors associated	Construction
147	Taman metro maya	Residential	1,7	42	Infocast property	Completed
217	-	Industrial	1,2	1	-	Construction
218	Anchor Bolt	Industrial	1,3	1	Tetuan Syw industry sdn bhd	Construction
219	Taman Debunga	Residential	3	96	SP Juta sdn bh	Construction

Sungai Siput

Nr	Name project	Typology	Hectare	Units	Developer	Phase
220	PR1MA @ Sungai Siput	Residential	41	957	-	Completed
221	Taman Tasik Saujana	Residential	10	426	Kinta Saujana	Constuction

Total nr of projects	**2**
Construction phase	1
Completed	1
Total nr of units	1383
Of which residential	1383
Construction phase	426
Completed	957
Average units per project	691
when townships excluded	-
Total hectare	51
Resi. + Towns. Hectare	51

Typology	
Residential	2
Industrial	0
Commercial	0
Mixed-use	0
Township	0
Other	0

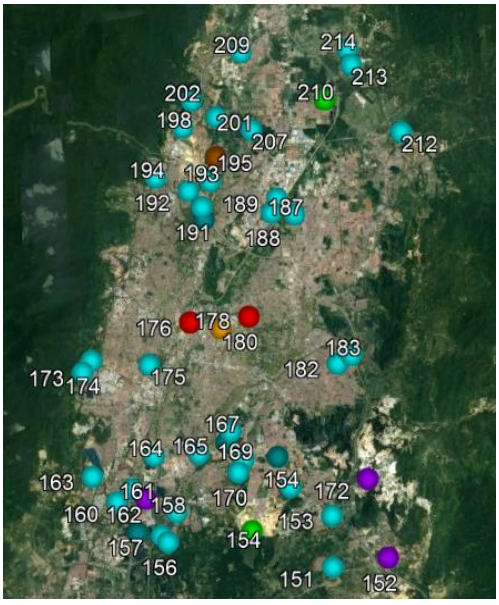
Kuala Kangsar

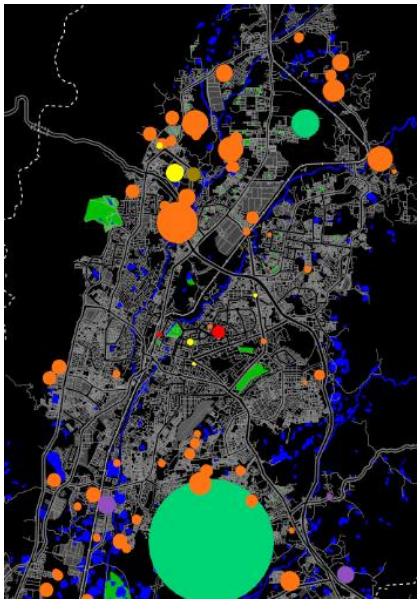
Total nr of projects	**3**
Construction phase	3
Completed	0
Total nr of units	505
Of which residential	505
Construction phase	505
Completed	0
Average units per project	168
when townships excluded	-
Total hectare	20
Resi. + Towns. Hectare	20

Typology	
Residential	3
Industrial	0
Commercial	0
Mixed-use	0
Township	0
Other	0

Nr	Name project	Typology	Hectare	Units	Developer	Phase
222	Sierra @ taman Alamanda Kuala Kangsar	Residential	15	389	Wild wisdom sdn bhd	Construction
223	Chandan putri	Residential	1,3	32	Liew wan khang & sons reality sdn bhd	Construction
224	Puncak Harmoni Kuala Kangsar	Residential	3,5	84	Kedah Holdings sdn bhd	Construction

Ipoh





Total nr of projects	**66**
Construction phase	58
Completed	8
Total nr of units	21587
Of which residential	20347
Construction phase	20121
Completed	1466
Average units per project	354
when townships excluded	196
Total hectare	**905**
Resi. + Towns. Hectare	859
	0

Typology	
Residential	53
Industrial	3
Commercial	5
Mixed-use	2
Township	2
Other	1

Nr	Name project	Typology	Hectare	Units	Developer	Phase
151	-	Residential	12	380	Proaktif SS development	Construction
152	-	Industrial	9	3	-	Construction
153	Pavillion Ville	Residential	1	100	LSK Capital sdn bhd	Construction
154	Straits eco	Residential	5	100	Dunia Mewah Sdn Bhd	Completed
155	Bandar Seri Botani	Township	507	7860	Taiko Group of Companies	Construction
156	-	Residential	2,7	70	-	Construction
157	PPA1M	Residential	7	362	-	Construction
158	-	Residential	3	40	-	Construction
159	Parkview sentosa	Residential	2	83	Rkr holdings sdn bhd	Construction
160	Double Green	Residential	2	143	SB Group	Construction
161	Ipoh Shoe City	Industrial	10,8	146	Perak Footwear Industry Association	Construction
162	Parkview Boulevard	Residential	7	200		Construction
163	Hillfront residences	Residential	6	126	Excellent Realty Sdn Bhd	Construction
164	Dibuka Jualan	Residential	1,8	50	Total investment sdn bhd	Completed
165	-	Residential	1,8	20	-	Completed

166	-	Residential	3,8	85	-	Completed
167	Zen 88 homes	Residential	3,2	88	Eadepro residence	Construction
168	Taman Lapanga Harmoni (fase 3)	Residential	1,5	24	Seong maju properties sdn bhd	Construction
169	Ipoh South Precinct	Residential	5	92	-	Completed
170	Green Park	Residential	16	276	Kaizen	Construction
171	-	Residential		64	Mawar Angkasa Sdn bhd	Construction
172	-	Industrial	1	1	-	Construction
173	-	Residential	6	50	-	Completed
174	-	Residential	7	100	-	Construction
175	Falim avenue	Residential	2	51	-	Construction
176	Kefiaman lestari	Mixed use	0,8	100	Lida property	Construction
177	-	Commercial	0,4	40	Taiko development corporation	Construction
178	ICC Ipoh Convention Centre	Commercial	1,34	300	Sycal ICC properties	Construction
179	Fair Park (PR1MA)	Residential	0,7	252	Perbadanan pr1ma malaysia	Construction
180	Basco avenue	Mixed use	5	600	Basco	Construction
181	-	Residential	1	216	-	Construction
182	-	Residential	0,6	14	Infinity development	Construction
183	-	Residential	3,5	107	Omega Zen sdn bhd	Construction
184	-	Residential	1,7	72	Al-aminy sdn bhd	Construction
185	Bond Square	Commercial	0,5	20	-	Construction
186	-	Residential	0,1	22	-	Construction
187	Palm Ville Fasa 3	Residential	0,6	18	Vega Supreme sdn bhd	Construction
188	-	Residential	1,8	32	-	Construction
189	-	Residential	5	194	Ritma setia sdn bhd	Construction
190	Ipoh Premier City (Genesis fase) PPA1M	Residential	10	176	DKLS Premierhome	Construction
191	Ipoh Premier city (rest of land area)	Residential	54	-	DKLS Premierhome	Construction
192	One Meru	Residential	3	35	PCB Development Sdn Bhd	Construction
193	Daman residence	Residential	9,7	1320	PCB development sdn bhd	Construction
194	-	Residential	6	-	Perak state	Construction
195	KPTM Ipoh	School	6	-	Majlis Amanah Rakyat	Construction
196	Scientex Meru Heights Residences	Residential	6	556	Scientex	Construction
197	Meru Aria	Commercial	1,2	30	Meru Properties Sdn Bhd	Construction
198	PR1MA @ Bandar Meru Raya	Residential	3,6	1011	-	Completed
199	Green acres Retirement village	Residential	3,5	28	Total investment sdn bhd	Construction
200	Meru 2	Residential	22	1479	Scientex quatari sdn bhd	Construction
201	Meru Perdan 2	Residential	3	63	MK land	Construction
202	Meru Idaman (fase 1)	Residential	6	65	Kinta Properties	Construction
203	Animation Theme Park	Commercial	10	-	Animation Theme Park Sdn Bhd	Construction
204	Garden residence	Residential	3,5	43	-	Construction
205	Taman klebang emas	Residential	2,2	58	-	Completed
206	Cadangan membina	Residential	1	22	Simplex phoenix sdn bhd	Construction
207	-	Residential	20	-	MK Land	Construction
208	Taman Klebang Rima	Residential	5	106	Rima Properties Group	Construction
209	Desa Chemor Megah	Residential	9	168	Liew yin yin group	Construction
210	Casa residence (PPA1M)	Township	25	2150	Casa Subang sdn bhd	Construction
211	Kini Dibuka Untuk Julan (Fasa terakhur)	Residential	0,7	32	-	Construction
212	Taman Tanjung Utara	Residential	20	491	Upaya emas sdn bhd	Construction
213	-	Residential	15	754	Generasi simbolik sdn bhd	Construction
214	Taman Kinding Raya	Residential	4	98	Diamond maxim sdn bhd	Construction
215	Taman Kinding Perdana	Residential	9	316	-	Construction
216	-	Residential	-	85	-	Construction

Appendix 7: Built-up surface per urban area

The data for the built-up surface has been obtained from JPBD (June 2019). The dataset 'existing land-use' has been used. For each urban area, the total urban land use is calculated by as *the sum of the total land use of the corresponding mukims, minus the sum of the non-urban land use (water body, forest, agriculture and vacant land)*. The result is considered as the urban (or built-up) land use, which exists of **Industry, Infrastructure and utilities, Institutions, Commercial, Mixed Development, Transportation, Housing and Recreation.** The built-up surface per urban area is presented in the yellow box (in hectare).

7.1 Study area

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Majilis Bandaraya Ipoh	881	30429	2513	1118	2170	1057	31	7091	9754	7240	1417	1752	**65453**
(= mukim Ulu Kinta+Sungai Raia)	1,3%	46,5%	3,8%	1,7%	3,3%	1,6%	0,0%	10,8%	14,9%	11,1%	2,2%	2,7%	**100,0%**
Built-up area	-	-	2513	1118	2170	1057	31	7091	-	7240	-	1752	**22972**
Ipoh	-	-	11%	5%	9%	5%	0%	31%	-	32%	-	8%	**100%**

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Kamunting	20	1724	5	21	323	8	0	210	1391	329	150	166	**4347**
	0,5%	39,7%	0,1%	0,5%	7,4%	0,2%	0,0%	4,8%	32,0%	7,6%	3,5%	3,8%	**100,0%**
Asam Kumbang	363	26	421	145	218	49	0	1131	1479	1225	941	92	**6090**
	6,0%	0,4%	6,9%	2,4%	3,6%	0,8%	0,0%	18,6%	24,3%	20,1%	15,5%	1,5%	**100,0%**
Penkalan Aor	56	0	39	14	30	12	0	21	380	359	96	31	**1038**
	5,4%	0,0%	3,8%	1,3%	2,9%	1,2%	0,0%	2,0%	36,6%	34,6%	9,2%	3,0%	**100,0%**
Tupai	53	2800	53	128	286	26	0	248	1481	275	60	40	**5450**
	1,0%	51,4%	1,0%	2,3%	5,2%	0,5%	0,0%	4,6%	27,2%	5,0%	1,1%	0,7%	**100,0%**
*Bandar Taiping**	15	4	0	7	107	29	0	76	0	72	13	68	**391**
	3,8%	1,0%	0,0%	1,8%	27,4%	7,4%	0,0%	19,4%	0,0%	18,4%	3,3%	17,4%	**100,0%**
Built-up area	-	-	518	315	964	124	0	1686	-	2260	-	397	**6264**
Taiping-Kamunting	-	-	8%	5%	15%	2%	0%	27%	-	36%	-	6%	**100%**

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Lumut	3150	5797	849	16	1182	468	0	391	8673	688	1756	238	**23208**
	13,6%	25,0%	3,7%	0,1%	5,1%	2,0%	0,0%	1,7%	37,4%	3,0%	7,6%	1,0%	**100,0%**
Sitiawan	107	0	114	728	311	152	0	144	25680	1700	638	100	**29674**
	0,4%	0,0%	0,4%	2,5%	1,0%	0,5%	0,0%	0,5%	86,5%	5,7%	2,2%	0,3%	**100,0%**
Built-up area	-	-	963	744	1493	620	0	535	-	2388	-	338	**7081**
Lumut-Sitiawan	-	-	14%	11%	21%	9%	0%	8%	-	34%	-	5%	**100%**

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Durian Sebatang	792	0	118	10	280	90	0	*1050*	28826	998	303	59	**32526**
	2,4%	0,0%	0,4%	0,0%	0,9%	0,3%	0,0%	3,2%	88,6%	3,1%	0,9%	0,2%	**100,0%**
Built-up area	-	-	118	10	280	90	0	1050	-	998	-	59	**2605**
Teluk Intan	-	-	5%	0%	11%	3%	0%	40%	-	38%	-	2%	**100%**

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Bidor	955	3518	84	26	335	11	0	713	13392	465	2089	108	**21696**
	4,4%	16,2%	0,4%	0,1%	1,5%	0,1%	0,0%	3,3%	61,7%	2,1%	9,6%	0,5%	**100,0%**
Built-up area	-	-	84	26	335	11	0	713	-	465	-	108	**1742**
Bidor	-	-	5%	1%	19%	1%	0%	41%	-	27%	-	6%	100%

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Batang Padang	502	-	211	102	743	19	0	550	13094	518	901	21	**16661**
	3,0%	-	1,3%	0,6%	4,5%	0,1%	0,0%	3,3%	78,6%	3,1%	5,4%	0,1%	**100,0%**
Built-up area	-	-	211	102	743	19	0	550	-	518	-	21	**2164**
Tapah-Tapah Road	-	-	10%	5%	34%	1%	0%	25%	-	24%	-	1%	100%

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Kampar	933	-	156	95	182	247	0	1097	14145	616	782	90	**18343**
	5,1%	-	0,9%	0,5%	1,0%	1,3%	0,0%	6,0%	77,1%	3,4%	4,3%	0,5%	**100,0%**
*Bandar Kampar**	1	-	1	1	16	15	0	79	51	29	28	5	**226**
	0,4%	-	0,2%	0,4%	7,1%	6,7%	0,0%	35,0%	22,6%	12,9%	12,4%	2,2%	**100,0%**
Built-up area	-	-	157	96	198	262	0	1176	-	645	-	95	**2629**
Kampar	-	-	6%	4%	8%	10%	0%	45%	-	25%	-	4%	100%

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Bota	470	7	52	134	894	73	0	732	12462	339	2152	98	**17413**
	2,7%	0,0%	0,3%	0,8%	5,1%	0,4%	0,0%	4,2%	71,6%	1,9%	12,4%	0,6%	100,0%
Built-up area	-	-	52	134	894	73	0	732	-	339	-	98	**2322**
Seri Iskandar	-	-	2%	6%	39%	3%	0%	32%	-	15%	-	4%	100%

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Sungai Terap	679	2	303	91	218	26	0	1919	3575	950	3137	327	**11227**
	6,0%	0,0%	2,7%	0,8%	1,9%	0,2%	0,0%	17,1%	31,8%	8,5%	27,9%	2,9%	100,0%
Built-up area	-	-	303	91	218	26	0	1919	-	950	-	327	**3834**
Batu Gajah (+pusing)	-	-	8%	2%	6%	1%	0%	50%	-	25%	-	9%	100%

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Teja	243	13679	375	41	161	17	0	503	10091	226	1345	25	**26706**
	0,9%	51,2%	1,4%	0,2%	0,6%	0,1%	0,0%	1,9%	37,8%	0,8%	5,0%	0,1%	100,0%
Built-up area	-	-	375	41	161	17	0	503	-	226	-	25	**1348**
Gopeng	-	-	28%	3%	12%	1%	0%	37%	-	17%	-	2%	100%

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Kota Lama Kiri	79	10736	39	7	104	21	0	35	3687	1315	86	20	**16129**
	0,5%	66,6%	0,2%	0,0%	0,6%	0,1%	0,0%	0,2%	22,9%	8,2%	0,5%	0,1%	100,0%
Saiong	264	12919	6	6	207	19	0	117	4163	896	184	53	**18834**
	1,4%	68,6%	0,0%	0,0%	1,1%	0,1%	0,0%	0,6%	22,1%	4,8%	1,0%	0,3%	100,0%
Built-up area	-	-	45	13	311	40	0	152	-	2211	-	73	**2845**
Kuala Kangsar	-	-	2%	0%	11%	1%	0%	5%	-	78%	-	3%	100%

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Pengkalan Baharu	817	4477	145	165	79	32	0	-	18192	556	280	9	**24752**
	3,3%	18,1%	0,6%	0,7%	0,3%	0,1%	0,0%	-	73,5%	2,2%	1,1%	0,0%	100,0%
Built-up area	-	-	145	165	79	32	0	-	-	556	-	9	**986**
Pantai Remis	-	-	15%	17%	8%	3%	0%	-	-	56%	-	1%	100%

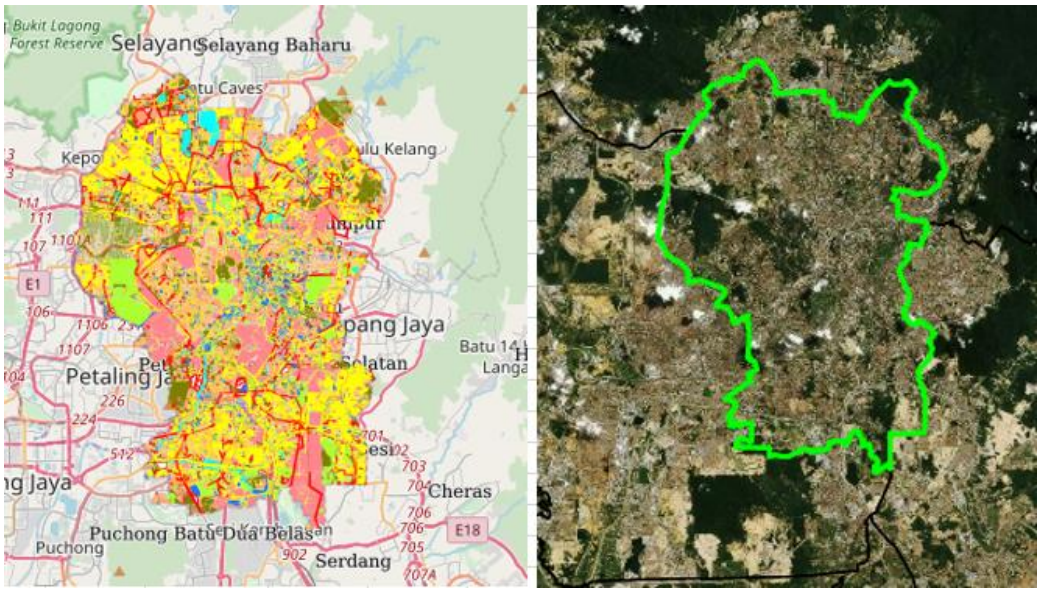
Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Sungai Siput	118	-	166	33	337	41	0	107	16082	710	951	59	**18604**
	0,6%	-	0,9%	0,2%	1,8%	0,2%	0,0%	0,6%	86,4%	3,8%	5,1%	0,3%	100,0%
Built-up area	-	-	166	33	337	41	0	107	-	710	-	59	**1453**
Sungai Siput	-	-	11%	2%	23%	3%	0%	7%	-	49%	-	4%	100%

7.2 Benchmark Penang and Kuala Lumpur

Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Timur Laut (district)	123	6494	91	109	984	472	16	1108	107	2278	515	424	**12721**
	1,0%	51,0%	0,7%	0,9%	7,7%	3,7%	0,1%	8,7%	0,8%	17,9%	4,0%	3,3%	100,0%
Built-up area	-	-	91	109	984	472	16	1108	-	2278	-	424	**5482**
North East Penang	-	-	2%	2%	18%	9%	0%	20%	-	42%	-	8%	100%

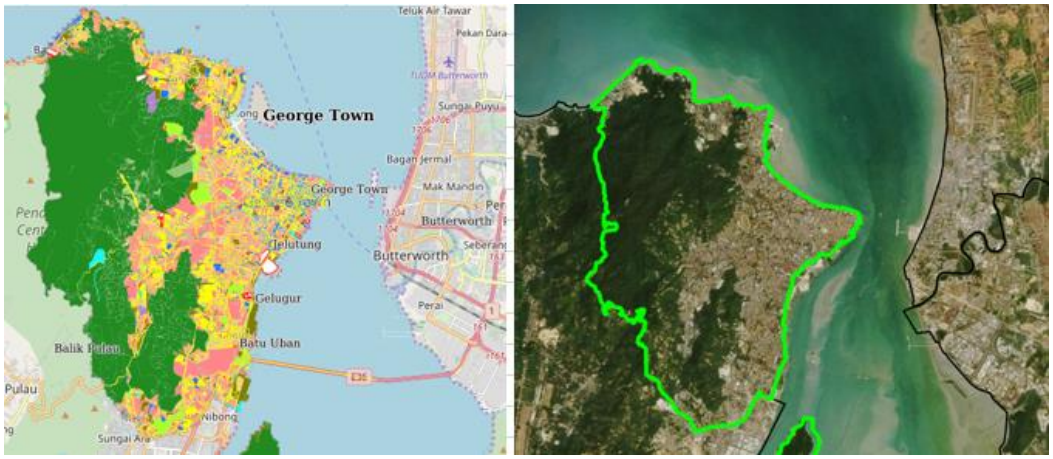
Corresponding mukim:	Water	Forest	Industry	Infra	Institut.	Commerc.	Mixed D.	Transporta	Agricult	Housing	Vacant	Recr.	*total*
Dewan Bandaraya K.L.	631	12	468	1004	3657	1443	23	5791	3	6080	3167	2219	**24498**
	2,6%	0,0%	1,9%	4,1%	14,9%	5,9%	0,1%	23,6%	0,0%	24,8%	12,9%	9,1%	100,0%
Built-up area	-	-	468	1004	3657	1443	23	5791	-	6080	-	2219	**20685**
Central Kuala Lumpur	-	-	2%	5%	18%	7%	0%	28%	-	29%	-	11%	100%

Central Kuala Lumpur (Bandaraya K.L.)



Existing land-use in Bandaraya K.L. (left) and the administrative boundary (right). Sources: JPBD (2018), Citypopulation (n.d)

Northeast Penang (Timur Laut district)



Existing land-use in Northeast Penang. (left) and the administrative boundary (right). Sources: JPBD (2018), Citypopulation (n.d)

Appendix 8: Population growth analysis

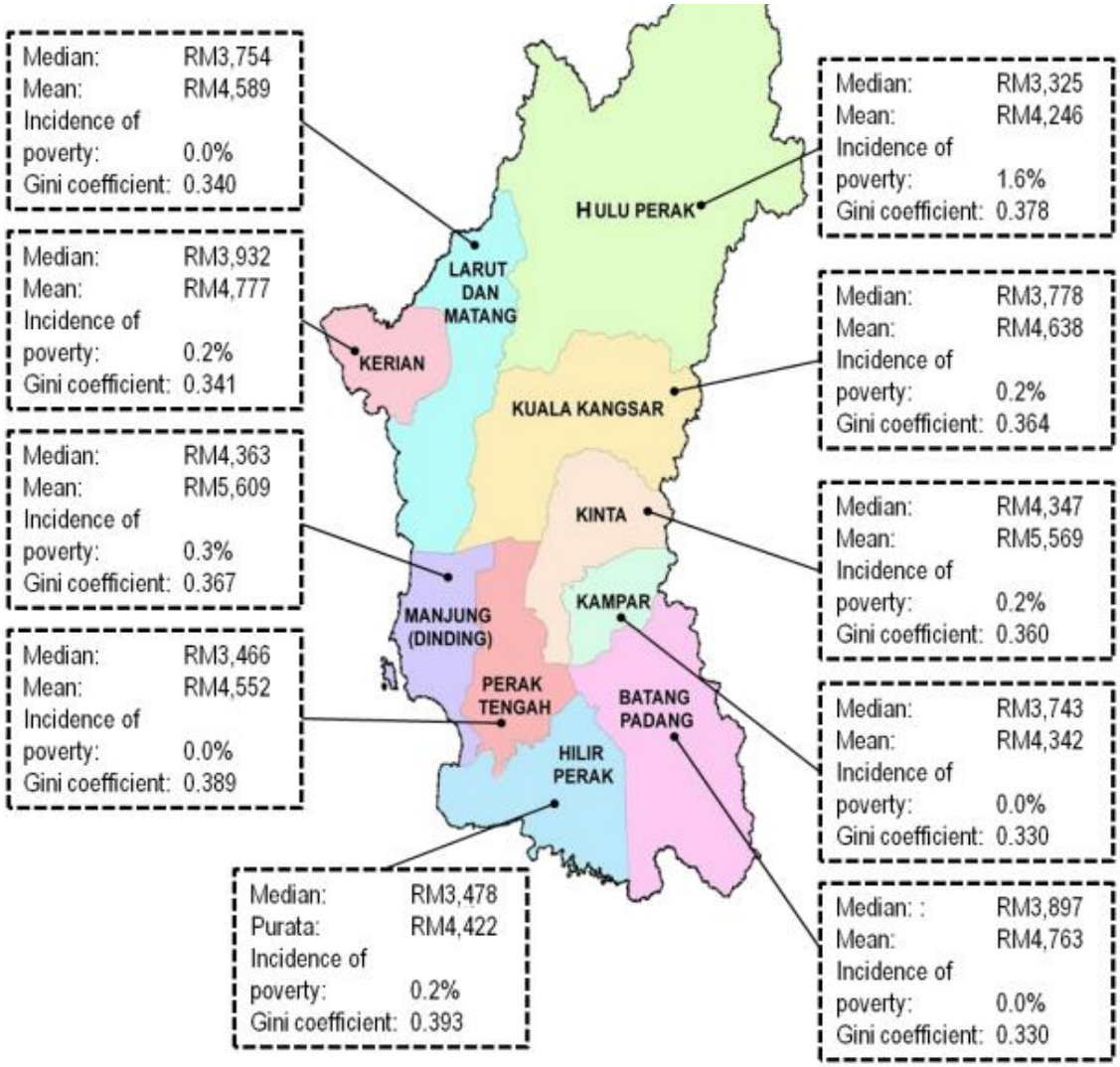
8.1 District level

District	Population				Average annual growth rate (%)			Area size	(people/sq km)	
	1991	2000	2010	2020 Est.*	1991-2000	2000-2010	2010-2020	km2**	2010	2020
Hulu Perak	81636	82551	88845	102600	0,12	0,73	1,44	6560	14	16
Larut, Matang & Selama	271882	273641	315285	371900	0,07	1,42	1,65	2113	149	176
Kerian	148720	152911	173625	201400	0,31	1,27	1,48	921	189	219
Kuala Kangsar	146684	144418	152590	167500	-0,17	0,55	0,93	2564	60	65
Kinta	549198	622106	735601	851300	1,39	1,68	1,46	1305	564	652
Kampar	78701	81387	95402	107100	0,37	1,59	1,16	670	142	160
Perak Tengah	75574	82153	98897	114100	0,93	1,85	1,43	1279	77	89
Manjung	168331	191132	223804	265500	1,41	1,58	1,71	1114	201	238
Hilir Perak (incl. Bagan Datuk)	202059	190868	201168	221600	-0,63	0,53	0,97	1744	115	127
Batang Padang (incl. Mualim)	154686	152201	173211	202300	-0,18	1,29	1,55	2728	63	74
Bagan Datuk	-	-	-	*73600*	-	-	-	952	-	77
Mualim	-	-	-	*110800*	-	-	-	934	-	119
Hilir Perak (exlc. Bagan Datuk)	-	-	-	*148000*	-	-	-	792	-	187
Batang Padang (excl. Mualim)	-	-	-	*91500*	-	-	-	1794	-	51
Perak State (Total)	**1877471**	**1973368**	**2258428**	**2605300**	**0,55**	**1,35**	**1,43**	**20998**	**108**	**124**

8.2 City level

Urban area	Mukim	Population			Average annual pop. growth rate (%)	
		2000	2010	2016*	2000-2010	2010-2016
	Ulu Kinta	533027	639512	695800	1,82	1,41
	Sungai Raia	19094	29706	35100	4,42	2,78
Ipoh		**552121**	**669218**	**730900**	**1,92**	**1,47**
	Kamunting	24412	36243	42200	3,95	2,54
	Asam Kumbang	78080	98488	109000	2,32	1,69
	Pengkalan Aor	30206	37501	41300	2,16	1,61
	Tupai	31032	35408	38000	1,32	1,18
Taiping-Kamunting		**163730**	**207640**	**230500**	**2,38**	**1,74**
	Lumut	47628	55590	60800	1,55	1,49
	Sitiawan	96265	123326	138700	2,48	1,96
Lumut-Sitiawan		**143893**	**178916**	**199500**	**2,18**	**1,81**
Teluk Intan	Durian Sebatang	**77361**	**88695**	**100700**	**1,37**	**2,12**
Bidor	Bidor	**30389**	**31244**	**34700**	**0,28**	**1,75**
Tapah	Batang Padang	**29264**	**33959**	**40200**	**1,49**	**2,81**
Kampar	Kampar	**57389**	**69940**	**77700**	**1,98**	**1,75**
Seri Iskandar	Bota	**23468**	**43062**	**52600**	**6,07**	**3,33**
Batu Gajah - Pusing	Sungai Terap	**39434**	**49095**	**54000**	**2,19**	**1,59**
Gopeng	Teja	**23998**	**26363**	**28400**	**0,94**	**1,24**
	Kota Lama Kiri	23864	24081	26000	0,09	1,28
	Saiong	20909	25145	28600	1,84	2,15
Kuala Kangsar		**44773**	**49226**	**54600**	**0,95**	**1,73**
Pantai Remis	Pengkalan Baharu	**28045**	**28832**	**30400**	**0,28**	**0,88**
Sungai Siput	Sungai Siput	**43385**	**48954**	**54700**	**1,21**	**1,85**

Appendix 9: Household income per district



Source: DOS, 2017. Data based on the Household Income and Basic Amenities Survey.

Appendix 10: Land transaction data

This data is obtained from the Valuation and Property Services department (JPPH) for the period January 2014 – January 2019. The price per square feet is based on the average of the median prices.

Location	Total transactions	Median psf (RM/ft2)
	(jan 2014 - jan 2019)	
Study area average	**8179**	***13,0***
Ipoh	2116	*24,0*
Lumut	146	*22,6*
Sitiawan	454	*20,5*
Lumut-Sitiawan	600	*21,5*
Taiping	793	*19,9*
Kamunting	298	*15,6*
Taiping-Kamunting	1091	*17,8*
Teluk Intan	378	*15,4*
Kampar	303	*10,4*
Tapah	90	*9,1*
Bidor	279	*6,5*
Seri Iskandar	217	*10,1*
Batu Gajah	612	*11,7*
Gopeng	166	*11,6*
Sungai Siput	349	*9,4*
Kuala Kangsar	287	*11,2*
Perak	**10698**	**14,4**

Median PSF	2014	2015	2016	2017	2018
Study area average	**12,9**	**14,6**	**13,6**	**17,2**	**15,9**
Ipoh	19,2	20,8	23,6	26,3	30,0
Lumut	15,1	19,2	17,0	32,8	28,7
Sitiawan	23,5	22,3	12,1	23,0	21,6
Lumut-Sitiawan	19,3	20,7	14,5	27,9	25,2
Taiping	18,3	17,4	21,7	20,3	21,8
Kamunting	13,9	14,3	15,1	18,2	16,5
Taiping-Kamunting	16,1	15,9	18,4	19,3	19,2
Teluk Intan	14,9	14,9	15,0	22,2	10,0
Kampar	10,2	12,3	14,2	9,5	6,0
Tapah	5,9	7,8	10,0	11,5	10,4
Bidor	5,9	5,4	5,8	6,8	8,7
Seri Iskandar	7,6	11,1	8,6	12,8	10,6
Batu Gajah	12,5	11,0	10,6	12,5	11,7
Gopeng	6,9	20,6	12,5	8,9	9,2
Sungai Siput	7,0	9,4	8,6	10,0	12,0
Kuala Kangsar	10,0	10,1	10,2	13,2	12,3
Perak	**13,5**	**14,3**	**14,3**	**14,7**	**15,3**

Appendix 11: Applications for the 'Perakku' houses

This data is obtained directly from the LPHP (2019) and shows the income group and origin of applicants for Perakku houses. For the spatial analyses, Ipoh has been merged with the Kinta district.

RINGKASAN

GAJI	JUMLAH	PERATUSAN
PEMOHON GAJI RM0 - RM580	766	5.52%
PEMOHON GAJI RM581 - RM2000	10366	74.76%
PEMOHON GAJI RM2001 - RM3500	2548	18.38%
PEMOHON GAJI RM3501 - KEATAS	186	1.34%
JUMLAH	13866	100%

PEMOHON GAJI RM0 - RM580

KOD	DAERAH	JUMLAH PERMOHONAN	PERATUSAN
0	TIDAK DINYATAKAN	2	0%
1	Batang Padang	18	2%
2	Hilir Perak	20	3%
3	Manjung	54	7%
4	Larut, Matang dan Selama	242	32%
5	Kinta	39	5%
6	Kuala Kangsar	24	3%
7	Hulu Perak	15	2%
8	Kerian	153	20%
9	Perak Tengah	60	8%
10	Slim River	72	9%
11	Kampung Gajah	2	0%
12	Kampar	10	1%
13	Ipoh	29	4%
14	Sungai Siput	18	2%
15	Selama	0	0%
16	Lenggong	6	1%
17	Pengkalan Hulu	1	0%
18	Lain-Lain (Sg.Siput)	1	0%
JUMLAH		766	100%

Monthly household income between RM0-RM580

PEMOHON GAJI RM581 - RM2000

KOD	DAERAH	JUMLAH PERMOHONAN	PERATUSAN
0	TIDAK DINYATAKAN	23	0%
1	Batang Padang	333	3%
2	Hilir Perak	170	2%
3	Manjung	953	9%
4	Larut, Matang dan Selama	2235	22%
5	Kinta	1142	11%
6	Kuala Kangsar	263	3%
7	Hulu Perak	255	2%
8	Kerian	1667	16%
9	Perak Tengah	1144	11%
10	Slim River	972	9%
11	Kampung Gajah	23	0%
12	Kampar	203	2%
13	Ipoh	718	7%
14	Sungai Siput	144	1%
15	Selama	11	0%
16	Lenggong	83	1%
17	Pengkalan Hulu	17	0%
18	Lain-Lain (Sg.Siput)	10	0%
JUMLAH		10366	100%

Monthly household income between RM581-RM2000

PEMOHON GAJI RM2001 - RM3500

KOD	DAERAH	JUMLAH PERMOHONAN	PERATUSAN
0	TIDAK DINYATAKAN	19	1%
1	Batang Padang	72	3%
2	Hilir Perak	45	2%
3	Manjung	315	12%
4	Larut, Matang dan Selama	308	12%
5	Kinta	458	18%
6	Kuala Kangsar	75	3%
7	Hulu Perak	69	3%
8	Kerian	240	9%
9	Perak Tengah	413	16%
10	Slim River	208	8%
11	Kampung Gajah	3	0%
12	Kampar	106	4%
13	Ipoh	147	6%
14	Sungai Siput	15	1%
15	Selama	0	0%
16	Lenggong	52	2%
17	Pengkalan Hulu	0	0%
18	Lain-Lain (Sg.Siput)	3	0%
JUMLAH		2548	100%

Monthly household income between RM2001-RM3500

PEMOHON GAJI RM3501 - KEATAS

KOD	DAERAH	JUMLAH PERMOHONAN	PERATUSAN
0	TIDAK DINYATAKAN	2	1%
1	Batang Padang	5	3%
2	Hilir Perak	4	2%
3	Manjung	25	13%
4	Larut, Matang dan Selama	8	4%
5	Kinta	64	34%
6	Kuala Kangsar	5	3%
7	Hulu Perak	6	3%
8	Kerian	16	9%
9	Perak Tengah	15	8%
10	Slim River	10	5%
11	Kampung Gajah	0	0%
12	Kampar	12	6%
13	Ipoh	8	4%
14	Sungai Siput	0	0%
15	Selama	0	0%
16	Lenggong	5	3%
17	Pengkalan Hulu	0	0%
18	Lain-Lain (Sg.Siput)	1	1%
JUMLAH		186	100%

Monthly household income over RM3500>

Appendix 12: Interviews

Company/Agency: Land and Mineral Director Office (PTG) Perak **Location:** Ipoh

Person: Muhammad Nazri **Date:** 1-7-2019

Function: Director of the Land Development Unit

PTG is a land administration and management organisation. As one of the main frontline agencies of the state government, PTG Perak has a role and responsibility in leading the improvement of land administration matters throughout Perak. The PTG Perak is the land office on the state level (each district also has a land office) and is based in Ipoh. Mr Nazri is the head of the land development unit and is directly responsible processing applications related to development of land.

Actors responsible for the formation of zoning-plans

In Perak, basically three main types of land-use: Industry, Building and Agriculture. Sometimes, these are more specified, for example in residential and commercial. For a specified piece of land, it's land-use status can be found in zoning-plans.

The role of JPBD in creating structural plans

Department of Town and Country Planning (JPBD), also known as PlanMalaysia, is responsible for the formation of structural plans. On the local level, these are called Local Plans. At the state level, it is called the State Strategic Plan. At the national level, they prepare the National Physical Plan.

The State Structural and Local Plans are financed by the federal government and the state government. Usually, 70% is contributed by the Federal Government and 30% by the State Government. Because the local authorities don't have enough financial resources to create these types of plans. Governments also work together with private consultancy firms for the creation of these plans. The State Plans and Local Plans are made for 20 years. For example, the new Local Plan for Ipoh will be finished next year (2020) and will be used until 2035-2040. This is different on the national level. National Physical Plans they only prepare for about 5 years.

For local plans, usually, they start preparing a new plan, 2 or 3 years before the current plan expires. In this phase, JPBD works together with private consultancy firms. In this phase, the consultant involves town planners and landowners to create a zoning-draft plan. When the draft is completed, they invite the public to comment on the plan and whether they agree with the zoning-plans for certain areas. This public engagement is called a publicity programme. Based on this response and other parties involved, they prepare the final plan in detail. Every land plot will be assigned to the related zoning. This plan goes to the State Planning Committee, the highest state planning authority. When this new Local Plan is approved in this meeting, it can be used.

Re-zoning: process and legal procedures

The process of converting land-use status in zoning plans is called re-zoning. When it comes to developing agriculture land, landowners need approval before they can convert land-use status from agriculture to building. Reasons behind the desire to transform land-use status can be twofold. One scenario is that the landowner himself wants to transform his land-use status. However, more often the landowner sells land to a real estate developer, who will use the land for building purposes. Before the developer can start building, he needs to transform land-use status from agriculture to building. Basically, there are two items you have to convert: the zoning plan itself and the land title. To do so, you need to go through a legal procedure.

Legal procedure

The land title indicates the type of land-use of a specified piece of land, for example, industrial land. If you own agricultural land and you want to transform it, you have a few options, which are listed in the National Land-Code. The most popular option is section 204. Section 204 is used for *surrender and …* By using this, they can submit the land-use transformation application to the local authority's (district land office). Then they have to prepare also a planning permission. When the application and planning permissions have been approved by the local authority, they submit the permission through section 204 to the land office. Then the land office checks and creates a draft version of the plan. This draft plan goes to the PTG Perak office (land office state level) and Mr Nazri will process the draft paper and adds additional information. When the paper is completed, it goes to the director, who makes final decision. So, final decision by state committee (state authority). Then they send back the revision to Mr Nazri, who looks into the decision and informs the state. Then the district level issues an offer letter, together with payment schedule, to pay some additional premium, based on the approval given by the state authority.

Premium is calculated based on market prices. The district office will issue a letter to the state, who will come up with a price (for example, RM10 per square feet). District office produces the offer letter. Then the landowner pays some premium (additional payment). Then they get the title converted to building or industry.

Premium (additional costs)

Transforming agriculture land is always an option, but the rates are quite high. The costs of industrial land are the highest. For residential and housing schemes the rates are a bit less high. Industrial land-use is the highest because most profits are made in these locations.

On what does the decisions of the state authority (for approval) depend on?

First, they will check the recommendation of the local authority (District level). Once you submit the application to the district office, the district officer is the local specialist, he is the land administrator of that district. The land administrator will give recommendation, whether this application should be approved or rejected. Usually, Mr Nazri completes the paper bases on the recommendation by the district officer (administrator). Most of the time, the state authority also makes the final decision based on that.

Actors involved in the decision-making process for land-use transformation

In some conditions, the land administrator has tendencies not to approve the application, because sometimes they have to take into account objection. Two reasons. (1). For example, sometimes neighbour land-owners don't agree on land-use transformations. Usually, there will be some objections from neighbouring lands. Sometimes the land administrator takes this into account. (2). Also, sometimes objections during the local authority meetings. The local authority meeting has a special committee for planning permission, this is called OSC, One Stop Centre. Here, some technical agencies related to the application, give their comments. Examples of these agencies are the DOE (Department of Environment), Public Works Department, Department of Irrigation and Drainage, Department or Town and Country Planning (JPBD).

When land-use is converted from agriculture to industrial, the DOE is invited to the meeting. DOE takes into account the impact on the environment, in the form of an EIA (Environmental Impact Assessment) report, when the proposed transformed area is more than 50 acres. DOE will emphasize and ask the landowner to prepare the EIA. Based on that they agree- or disagree with the land-use conversion.

Impacts of land-tax systems of the inefficiency of zoning-plans

(Explaining the efficiency of zoning-plans in the Netherlands: difficult to transform. According to local developers in Perak, however, this is rather easy. This indicates the inefficiency of zoning-plans).

There is some contradiction in the system. On the one hand, we spend a lot of money on these zoning plans, but the land-owner holds the right to convert his land-status. This has to do with the fact that most (local) governments don't see it as a problem. In fact, the district officer and local council president, they need developments. Because the annual 'quit rent' of residential/industrial land is higher than that of agriculture land. If I (Mr Nazri) was a district officer, I would rather accept the housing scheme as agriculture, because the annual quit rate of rent is higher. Therefore, the district offices and state offices stimulate developments, as it creates a higher cash-flow. The quit rent for industrial land is the highest (per hectare).

Let's use an example. In Perak, the total state revenue (rent, premiums, etc) that relates to land profits is 600 million a year, which is a lot. However, compared to other states, it is not that much. In Selangor (another state), the most developed district is Petaling, which itself contributes for also 600 million a year. This is because this district is highly developed with housing and industry. In Perak, the most developed district is Kinta. Looking at revenues from quit land rents only, Ipoh contributes for 68 million a year to the total quit land revenues of the state, which is 31% (the total of Perak is 218 million). Manjung has the seconds highest contribution, 35 million. In Taiping this is less high, because of the heritage in the area: fewer developments take place.

The state target for 2019 is actually higher than 218 million. This means that the target is not yet reached. To do so, governments stimulate housing and industrial developments (so they reach their targets). This is especially the case for the smaller districts. They might even promote the land-owner to develop his land.

Potential to control urban-sprawl

We use Taiping as an example. Because Taiping is the oldest town, lots of buildings and areas have a 'heritage' status. The former Airport in Taiping (100 acres area) is now considered as heritage. Even though in the direct surroundings of this area lots of housing schemes are being developed, the airport can not be developed, because the government considers it as heritage. So if a local government wants to prevent sprawl, they could give some areas a heritage-status, which makes it more difficult to get approval for development. A couple of weeks ago (in June 2019), some locals in Taiping protested, because they heard there were plans to develop the airport. In response, the government announced that the airport area now has the status of 'heritage', which stopped the development process.

Now let's take Hulu Perak (a rural area in the north) as an example. Here they only developed next to the roads, with urban sprawl as a result. In my opinion (Mr Nazri), the local authority should play there role, by educating the people about the potential of stopping sprawl. There is a lack of knowledge among local people. The local authorities do not insult and engage a lot with the land-owners. Because of this lack of knowledge, the land-owners do not know the potential of their land and how it might impact the area.

Scattered development as a development strategy

Most land that is located directly beside roads has an agriculture status. These areas have the highest development potential. Using your example of Batu Kurau (*I described the scattered development in the plantation area alongside the road),* you see development on random locations. But the developers are smart enough, and sometimes they use this as a strategy to retrieve more land. For example, a developer purchases a lot on a specific place. Next, he wants to buy the bordering lot. However, the land-owner doesn't want to sell his plantation area. What the developer does; he buys another land lot a bit further away, so that the other plantation lot (of the landowner who doesn't want to sell) is 'stuck' in between to housing developments. The developer will buy the other land lots in between his developments until the last landowner has no choice but selling his land since his land is not a suitable location for plantation farming anymore (becomes inefficient). In the end he has no choice to surrender. This is the strategy developers use.

So, the strategy of the developer is to purchase a few separated lots and connects them in the coming years as one area. As land management office this is difficult to foresee. Because it is only after a few purchases that such a

trend of a developer becomes visible and then it's too late to control it (because they already converted the land-use from agriculture to building).

Development potential of a location

The development potential of a location also depends on to what extent local governments (districts) encourage the developer to come in and the type of properties being developed in that area. The development potential of a location is influenced by multiple factors. Locations alongside roads have good potential because of their accessibility, especially in less populated areas, such as Hulu Perak. Connectivity (both in terms of electricity and road networks) is low in these areas, so strategic locations are alongside roads. However, if the government offers industrial land of 100 acres, but that area has not much connectivity accessibility, the development potential of the land plot is not so high. Industrial players look for locations that have good facilities to support their developments. If the utilities and infrastructure don't cover the area for a hundred percent, the location loses its potential. In some areas, therefore, we need to improve road networks, electricity, telecom etc.

Manjung

In Manjung for example, the new West-Coast expressway is being developed. This makes the development potential of the area very high, especially in combination with the Manjung Port. This makes the location friendlier to industry players. Because of the location advantages of this area, this area has become popular, which nowadays results in higher property prices in Manjung compared to other districts.

Seri Iskandar

A couple of advantages. One of them is that Seri Iskandar is a knowledge town with multiple universities. But if you look from a geographical point of view, Seri Iskandar is located in the middle between Ipoh and Manjung. People who commute from Ipoh to Manjung see these new developments in Seri Iskandar and find this location more convenient to stay. A lot of people commute between Ipoh/Seri Iskandar and Manjung because the property market in Manjung is rising. Therefore some developers find Seri Iskandar more interesting to develop because they can still offer reasonable prices houses, which makes it easier to sell.

Tapah

(*related to the township project besides the highway).* North of Tapah, besides the highway they build a new township project. This is a mix of commercial, housing, shops. They call in Bandar Transit Tapah (Tapah Transit Town). Tapah Estate, a private developer, is the landowner. Before this, the land was palm oil estate. The total area is about 100 acres. This is a strategic location, because its located with direct access to the highway, in a radius less than 1km from the north-south expressway, the main highway from Kuala Lumpur from the south to the north.

Land provision for affordable housing schemes

Most of the affordable housing schemes, such as PR1MA, is developed on government land. For example, the government has 20 acres in Ipoh, and find this location suitable for affordable housing schemes. In this case, the land will be given to the GLC (government-linked company), like Perak Development Cooperation (GLC on state-level) or PR1MA (Federal GLC). When the land is offered to the state GLC, the GLC will joint-venture with a developer to built-up the area with affordable housing. This means that the government offers very cheap land to the developer. So the cost to develop the land is much lower, compared to the situation in which a developer has to buy- and transform land himself. The land is already owned by the government, we call it 'state land': land that is not allocated to any parties. Sometimes, the government goes directly to a developer, not through a GLC. In this case, the land is even cheaper for the developer.

Sometimes, the government charges the developer only on a nominal rate. Compared to the normal process, they calculate the premium on the market value, but sometimes they use the nominal rate, which is much cheaper compared to the market value.

The state is responsible for the PR1MA housing schemes, but usually, the state offers the locations. Something like, we have 10 locations, and the federal government can select. So, the states offers the locations and PR1MA will choose some of these locations

Perakku Housing Programme

Started last year, and they plan to build around 52.000 in total until 2025. Private developers develop the Perakku houses, but the state controls the price. For example, the state might say that the maximum prices for the houses should be RM70.000. However, the developer only makes profits when he can build houses for RM100.000 minimum. In this case, the state might come up with new policies, so that the additional RM30.000 will be funded by the State. Until now, 6949 units have been completed, 10500 units under construction and 34808 units in planning phase. Developers combine these affordable units with medium-cost and high-cost units, to cover their costs.

Company/Agency: Immanuel Construction & Development **Location:** Seri Manjung

Person: Ricky Yu **Date:** 2-5-2019

Function: Director

Immanuel Construction & Development is a property developer, located in Seri Manjung, with around 100 employees. Aim of the interview is to develop a better understanding of the local construction market, recent trends in the industry, location factors and other drivers behind developments in the region.

Location factors

The large number of developments in this region has to do with the strategic location of Sitiawan, located close to the sea. The Lumut Port acts as a stop-over for ships travelling through the Strait of Malacca (-the main shipping channel between the Indian Ocean and the Pacific Ocean, which is considered as one of the most important shipping lanes in the world-). During recent years, the number of investments in this area is growing. Overseas investors come to this region and look for temporary housing. A large company that invests in this region is 'Vale Malaysia Minerals'.

Seven years ago, there was a large project in Lumut: a new powerplant. Because of this project, thousands of workers came to this area at the same time. The demand for housing was high, which resulted in more housing developments. Developers from other regions also came to Lumut and Sitiawan, because of the large demand for housing.

For us, we consider multiple location criteria. First, we look at the surrounding area and decide whether it is suitable for our target group. Then we also check the quality of the soil. When we are interested, we approach the landowner and asks if he wants to sell his land. Another option is a joint-venture with the landowner.

I recently finished one project in Taiping, a housing development of 30 units. We choose for Taiping because the land is cheaper and it's close to Butterworth. Land is expensive because of its strategic location. This area has a lot to offer, especially in logistic terms. Besides the harbour, there is also an international airport. Also, people from other cities, such as Pantai Remis, travel here. Pantai Remis has a large population, but there is no entertainment, only housing. This results in lots of building projects in this area. In Manjung and Sitiawan you can find most of the construction activity in Perak.

Future growth

Nowadays, property prices are still going up. The expectation is that more people will move to this area in the coming years. Twenty years ago, Ipoh was the most attractive city in this region. Nowadays it's Lumut, because of the location close to the sea and to the Pankor Island. Besides that, the new Express Highway will be finished around 2022 and passes by Lumut. This is another reason for investors to come to this region.

Land ownership

Most of the land in this area is public land, owned by the government. Besides that, sometimes there are also large parcels of land that are privately owned. My neighbour (–YNH Properties, one of the largest developers in this area-) owns around 1000 hectares of land in this area. The reason for this dates back to colonial times. When Malaysia became independent, the British left this region and sold their land to their workers. The father of my neighbour bought lots of lands back then. Later, his son adopted most of this land. This results in lots of developments by YNH Properties nowadays in this area.

Land acquisition

You can buy ground from the government very easily. Most of the land in the Manjung district is agricultural land. After you bought the land, the first step is to convert this land to commercial- or residential land. Then, you make

a detailed proposal for your new project. In this phase, the architect will be involved. After that, you show your building proposal to the government, who need to approve your proposal. Normally this takes around 9 months to 1 year. If your proposal involves housing development, the government will almost always approve. The only exception is when you want to develop a chemical fabric for example, but approval for housing development is very easy in Perak. When the government approves, you can start with construction.

With the new government, it is actually easier to get approval for building permits and to transform zoning-plans. The new government is more open, and they promote investments. Recently, the government approached me, asking to invest and build in this area, because they expect more tourists. The government also stimulates overseas investments and invites countries such as Japan, China, the U.S. and Brazil to invest in Malaysia.

Selling before constructing

Some developers first built and sell when the project is completed. Most of the time these are developers with more financial capital. Some developers have fewer financial resources, and they sell their units in advance. In this case, they put a commercial board at the building plot with information of the project. They wait until 70% of their units are sold before they start with construction.

Competition among developers

We see lots of Chinese developers coming to Malaysia. In Johor, all high-rise buildings are built by Chinese developers. In this area, there is very little high rise, because there is simply to much land available.
In Seri-Manjung are basically two developers based: my company and one of my neighbours, YNH properties. YNH is more active in this area. For us, the land in this area is too expensive. When the economy went down, bank loans became more expensive. It was difficult to build for me. That's why I started to look in other regions for land.

Trends in the construction industry

Fifteen years ago, the land here was cheap, and then land prices started to increase. Fifteen years ago, you paid for 3 acres of land around 400.000 RM. Nowadays, you pay for 3 acres around 4 million RM, ten times as much.
The last two years, the national steel economy has been down, which impacts building construction. In Malaysia, some developers temporarily stop building. Most of the building projects you see now, already started before the steel economy went down. Maybe the steel economy recovers in two or three years. I expect that the new government will play an important role in this.

Company/Agency: Sitia Awan Holdings Sdn Bhd. **Location:** Seri Manjung

Person: Hafizzi Ramat **Date:** 6-5-2019

Function: Manager

Setia Awan Holdings is a developer located in Seri Manjung. The private company is responsible for the development of the BBSAP township project, the largest development in the study area. An interview has been conducted with Mr Ramat, who works at the sale-department and is closely involved with the project. Besides financial knowledge, Mr Ramat holds information about the process of the project, the drivers behind the development and strategic location advantages.

Company profile

Seti Awan Holdings is one of the larger property developers in the area with over 500 employees. The HQ is located in Seri Manjung and exists of a sales- and operation office. The operation office exists of multiple departments, such as the planning department and the sales department. These departments work closely together. Setia Awan Holdings does not only focus on housing projects, but they also build hotels and plantation areas.

Drivers behind the BBSAP project

The BBSAP project exists of more than 10,000 residential units in total. Sita Awan Holdings is also planning to build a similar township project in Teluk Intan. This project in Teluk Intan is still in 'stage one', nothing is finalized yet. This takes a while. For example, the preparation for the BBSAP township project started in 2013.

Most developers build small housing projects, mostly called 'Taman'. Setia Awan Holdings chooses to build large townships. They choose for such an approach for multiple reasons, such as costs, connections with the government, and the vision they have. They want to build a township with there name, their brand. The township project has, therefore, a double role, as it also promotes the company.

Joint-Ventures

The government wants more and more affordable housing. The demand for housing rises, especially for the B40 group: this is the 40% lowest income group. That is the target group for this project. All the housing units in this township project are defined in the category of affordable housing. The units in this project are priced below RM200.000 (for terrace housing). Semi-D is RM220.000.

Sitia Awan Holdings works together with the government in the form of joint-ventures to built affordable houses. This collaboration is mainly with state authorities, such as the PKNP. The joint-venture for this township development was set up together with the last government but continues nowadays with the new government. Joint-ventures work only when the partnership is beneficial for both parties. For the government, the township is desirable, as it is their task to provide sufficient affordable housing for the (local) population. By the formation of joint-ventures they stimulate the housing supply. For the developer such agreements are beneficial, as the governments supports them, sometimes financially with incentives, sometimes by providing (public) land. Also, when they have the government on their side, it creates more trust among buyers.

Sitia Awan Holdings is the only developer responsible for the BBSAP project. They don't work together with other developers. They do however work together with contractors and architects. These are mostly local companies.

Target group

This project is aimed at multiple target groups. It is not only the local B40 group in Perak. Also, people from Kuala Lumpur will move to this location. Actually, more than 50% of the buyers come from outside Perak, mainly from Kuala Lumpur. The reason behind this is that they get a higher quality house for the same price as they used to

pay in KL. In fact, the township project allows them to buy and own a house, which is more difficult in KL (as most of the housing supply are residential units, or the prices are too high).

Location factors

The attractiveness of this location to develop stems from multiple locations factors. First, the Pankor Island (west of Lumut-Sitiawan) attracts lots of tourism to this area. We expect that this will grow because Pangkor will be a free-duty zone from next year on. This is announced by the new government.

Besides this, the west-coast expressway will be completed soon. This highway has a positive impact on the accessibility of this area. Therefore, we also choose to build a new township in Teluk Intan. This accessibility to KL makes this location extra interesting for buyers from KL.

The tourism industry on Pankor and the construction of the new highway create jobs. The affordable houses are attractive for the workers. We don't focus much on overseas workers. It is mainly purposed for Malay. We do build another project close to Sitiawan, about 1000 houses. This project will be more aimed to house overseas investors and workers, in a higher price segment.

Development process

Before, this area was designated as a plantation area (palm trees). Therefore, they needed to transform the land-use status into residential. Before this, we already make the plans for the project. With these plans we go to the landowner and to the local government, to show what we are building to plan. Based on these plans the decisions of land use transformation is made [he explains the land development processes as discussed in the interview with Mr Nazri from PTG Perak]. Ramat confirms that local authorities will almost always agree on the re-zoning permission, as long as there are affordable housing units are involved. Then the government will always support it. The re-zoning process does take quite long according to him.

The project exists of multiple phases. The first phase is finished last month. We are now giving the keys to the buyers. Phase 1, 2 and 3 are totally sold out already. Ramat explains that they use the typical Malaysian approach, by selling units in advance, before the construction. Therefore, they need approval in the form of an APDL permit.

Other strategic locations

Seri Iskandar

Setia Awan Holdings also completed some projects in Seri Iskandar, about 500 shop lots (commercial units) and 800 residential units. These units are both rented as sold. The type of shop-use is pre-planned. So in advance, Sitia Awan Holdings indicates which shops are used for which purposes.

According to Mr Ramat this location has a lot of development potential, because of the presence of universities. He refers to a location (?) in the south of Spain, where three universities are located, and that this location is fast growing because of the presence of knowledge. He thinks that Seri Iskandar has the same potential. However, Seri Iskandar nowadays misses some important ingredients. First of all, there is a lack of jobs in the area. Therefore, most students look for work in cities as Kuala Lumpur after they graduated. Mr Ramat sees potential in this, namely by creating more jobs in the area. This will take some time though, multiple years. Until now, however, there are not enough jobs in the area to keep the students there.

In terms of residential units, Sitia Awan Holdings build also the studio's in this area, aimed for the students. Most of these studios they sell to investors, who in turn rent it out to students.

Pantai Remis

They don't develop in this area. It's simply too small.

Taiping-Kamunting

Currently, they are exploring new locations in this area. They are not sure if they will develop here because first they need to check the quality of the soil. This is a common procedure they do for any new development. This takes some time, as it involves multiple studies.

High land costs in Lumut-Sitiawan

Mr Ramat confirms that the land prices are relatively high in this area, compared to other regions in Perak. According to him this has to do with the presence of Pankor Island, which makes the location attractive for developers to build hotels, also on the mainland.

Impact of the steel industry

During another interview (with Mr Yu, director of Immanuel Development & Construction) it became clear that last years some projects were on hold, because of the economy worked in their disadvantage (steel industry was down). Mr Ramat saw a similar trend in this area and he confirms that the steel industry impacted Sitiawan, but not heavily. He said that it was mostly the more expensive housing projects that were on hold, also because these are more difficult to sell. As they built mainly affordable houses (which are easier to sell), to continue constructing.

Local competition

We see a recent trend that more developers become interested in developing affordable houses, as these units are easier to sell. Therefore, we experience more competition in the market. Mr Ramat names some other large developers in this area, such as YNH. [This confirms the statement of Mr Yu in the other interview, namely that YHH is responsible for a lot of projects in the local market).

Preference for low-density housing projects

[I explain the contrast with the Netherlands, where developers recently started to build more high-rise, as this allows for more efficient land-use. In Perak, you see very little high-rise developments, which impacts the efficiency of urban forms. Why this preference for low-density housing projects?]

Two main reasons for this.

(1). Before they (Sitia Awan Holdings) start with a project, they always do a survey among potential buyers to see what kind of housing they prefer. These studies show that potential buyers don't like high-rise and prefer landed house. They want to see their car and do something on their land. Also, the quality of most apartments in KL is not comparable with the quality in the Netherlands. The living standards are poor, and most apartments are dirty.

(2). In KL the land becomes more scarce, and the land costs rise. Because of this, it is only profitable to built high-rise. In Perak, however, there is plenty land. This combination (land availability and personal preferences of buyers) is one of the main reasons why you see more landed houses in Perak.

In the township, we do build facilities such as gyms, which are normally present in most condominiums. So, people don't miss out on that and enjoy the same type of facilities. Also, we build other facilities such as schools, governmental offices (such as Manjung District council), police station, clinic, swimming pool, gym, badminton hall. So, people don't need to travel to Sitiawan for their facilities.

Mr Ramat explains that they don't provide public infrastructure, as they expect the government to take initiative on that part. As we built over 10000 houses, this means that a potential population of 40000 people will live here. We also create jobs there and other things.

Company/Agency: KIJAYA Real Estate **Location:** Teluk Intan

Person: Man Mei Ling **Date:** 3-5-2019

Function: Manager

KIJAYA Real Estate is a private developer, responsible for the development of the 'Richmond Residences' project in Teluk Intan. This is a relatively small project (37 units) but offers an interesting contrast with the affordable housing schemes, as this project is designated for the higher income class. Aim of the interview was, to see whether different motivations exist when it comes to private small-scale housing projects.

General information and progress

This project is actually the first project by Kijaya Real Estate. [explanation about the different type of units that are under construction]. The project exists of multiple phases. The first phase of the project is almost completed and exists of 37 units. Besides this, some facilities completed, namely a gym and swimming pool. These can only be used by the residents themselves and are not allowed for outsiders. The second phase still needs to be developed and will exist of 67 units. Phase 2 can be separated into two parts, 37 units of terrace houses and 1 bungalow. The other land (empty land plot next to the project) will be built in the future. The first part of phase 2 will be completed first, which will take around 2 years.

Selling before constructing

Not all the units have been sold so far. But over 80% is sold. Ling explains that actually, all developers operate this way, by selling minimum 80% of their units in advance, before they start with the construction phase. By doing so, they reduce their risks and create a cash-flow which they can use to pay for the construction costs.

Site-selection and location factors

According to Ling, almost every location in Malaysia is suitable for housing construction, as there is a high demand for (affordable) houses through the country. It depends more on the type of house they require. The prices of these houses are relatively high, namely, RM 500.000> for terrace houses and RM 700.000 for Semi-D. The housing prices are dependent on the materials we use: the quality of these houses is somewhat luxurious. In Teluk Intan, housing prices differ. There are also affordable houses in this area, just as in most cities. Most of the people that live here, work in Teluk Intan.

Impact of the steel industry

This project started more than 2 years ago. Since then, the steel industry went down, which slowed down the construction. However, we continued with construction. Some developers choose to put their projects on hold.

[recording stopped]

Company/Agency: Perak Housing and Property Board (LPHP) **Location:** Ipoh

Person: Mohamad Sabri Bin Ahmad **Date:** 21-5-2019

Function: Deputy Chief Executive Officer

LPHP is a governmental agency responsible for the regulation, promotion, coordination, facilitation and implementation of housing- and property development in Perak, mainly focussed on public and affordable housing. It is also responsible to provide public information about housing and real estate development in the state. An interview has been conducted with Mr Sabri, deputy CEO, who informed about general trends related to property development in Perak; land use and re-zoning; the implementation of housing policies; joint-ventures. Besides this, Mr Sabri provided and explained the features of the APDL-dataset.

The role of LPHP

LPHP acts as a consultant for the (state) government. LPHP advices state authorities on policies and strategies that should be adopted to promote the development of property and housing. It is also responsible for the execution and implementation of these policies.

Development permits

Before any developer wants to develop their housing scheme, they need to apply for an Advertising Permit and Developer Licence, or in short APDL, when they want to sell at least 70% of their units in advance. For any housing development in Malaysia it is the case that, before a developer wants to start with the actual construction of the project, they need to get this APDL from the Housing Ministry. The APDL indicates the number of developments per area, the selling prices, the overhang of the projects, etc. Before an APDL is provided, the developer needs to send the development permits from all the local authorities, such as the development orders, road and drainage permits, building permits, etc. So, you need all those permits first, before you can get an APDL. Before you start your development, you need to subdivide all the land first and need to get the title for each subdivision. For each piece of land, you get a title, such as residential land, industrial land, commercial land, etc. That is a step in the development process. Once you get the APDL, you can send a notice to local authorities to mention that you are ready to start your development.

Another procedure (another option) is if you want to develop without getting the financing from all the banks, and without the money from the buyers. In this case, the developer can decide to build first and then sell. In this case, they don't need the APDL. If you have enough money you can build first and then sell, but you still need a permit from local authorities. But, based on Mr Sabri's experience, there is no company that operates this way. Because all developers need money to invest in their projects, build infrastructure, etc.

[short discussion about the exact type of data I need for the analysis: which years, which type of permit. Decided to provide data up to 2017 (and exclude 2018) as this dataset is complete and checked]

According to Mr Sabri, the APDL is the most relevant indicator to see where actual construction takes place. Because, in case with building permits, sometimes the developers apply for a building permit with local authorities, but they wait with actual construction for a long time, until the economy is good, or the situation is right to settle their development. Therefore, building permits are less suitable for this type of analyses. The right information in relation to actual construction locations is the APDL. The APDL focusses however only on residential projects. For industrial and commercial developments, you don't need an APDL, but you do need the other permits from local authorities.

Affordable housing schemes

Mr Sabri explains that the state government of Perak recently (March 2019) launched a policy to develop 52.000 affordable houses towards 2022, called the 'Perakku Housing Programme', which is implemented since April. Affordable houses in Perak can be categorized into three types of affordable housing:

Perakku 1 = Low cost. *Town area, RM 90.000: Rural area, RM 70.000*
Perakku 2 = Medium cost. *Town area, RM 180.000: Rural area, RM 140.000*
Perakku 3 = Affordable housing. *Town area, RM. 250.000: Rural area, RM240.000*

The Perakku Housing programme is one of the drivers of affordable housing projects in Perak. It is difficult to say anything about the exact demand for affordable houses in Perak, because of a lack of data. But we do have a programme in Perak in which we ask people to register when you buy an affordable house. Until now, LPHP received over 13.000 applications for affordable houses. The projection of 52.000 houses is based on household incomes of 2016, which is used as a proxy where to locate affordable houses. Low-income groups are relatively high in Perak, compared to other regions such as Penang or Kuala Lumpur. Based on the B40 household income, LPHP sees that the largest part of this group is located in Ipoh. Therefore, they aim to build more affordable houses in Ipoh. Until now, 6949 units have been completed; 10,500 are under construction and 34,808 are still in the planning phase.

Federal affordable housing schemes

PPA1M and PR1MA are examples of federal affordable housing programmes that are implemented by LPHP in Perak. The Federal Government finances and initiatives these projects, and LPHP realizes these housing schemes, in collaboration with local developers.

Changing housing policies

Affordable housing policies obligate developers to include affordable houses in their development in two scenarios:

(a) When a developer starts a project on a land plot larger than 20 acres;
(b) Or when the developer constructs over 300 units.

When these conditions are met, the developer is obligated to develop affordable houses under the Perakku scheme. With the former policy, developers were not obligated to build affordable houses in *the first phase of the project*: they were allowed to construct the affordable houses in later development stages. Often, developers choose to build more expensive houses in the first phases, as these types of houses create the highest cash flows. During the later stages, the developer goes to the State Government for an appeal not to develop low-cost houses. In this case, they need to pay a levy to the government. This way they could avoid to developer low- and medium-cost houses. Our data indicate that during the 2013-2017 period, only 1,24% low-cost houses (similar to the Perakku 1 category) have been constructed. This indicates that the previous policy failed to stimulate the construction of affordable housing. Therefore, LPHP introduced a new policy since April 2019: now the developer needs to build the affordable houses in the first development phase of the project, which will ensure that the promised affordable houses will be constructed. Also, for high-density housing construction (over 8 hectares), developers can now use different 'components. More specific, in these situations they need to build at least 10% low-cost houses (Perakku 1); 20% middle cost (Perakku 2); and 20% affordable houses (Perakku 3). For the other 50%, the developer can sell units at market prices. This adjustment to the former policy must encourage private sector participation in the construction of affordable houses

Joint-ventures

LPHP coordinates and connects the government with private companies, to realize the implementation of property- and housing developments. It is also the task of LPHP to control whether proposals for new developments are in line with the vision of the federal government. For the realization of affordable houses, LPHP works closely

together with the Real Estate and Housing Developers' Association (REHDA). Mr Sabri explains that before they developed the housing policy, they discussed with REHDA what the selling prices of houses should be; how many units to build; and other more technical matters. Based on this, LPHP forms and creates the policy for Perak. So, REHDA is part of the committee that develops housing policies. LPHP is both responsible for the regulation of policies as for the actual realization of affordable housing projects. To do so, LPHP works together with other parties. Such collaborations are also important to monitor the status of housing developments. LPHP works together with State GLC's (Government Linked Companies), such as PKNP and SSI (State Secretary Incorporated), for the realization of affordable houses. Until now, 43.000 affordable houses have been planned (and are partly under construction) in collaboration with GLC's (excluding the private sector developments). Besides the collaboration with GLC's, LPHP joins together with developers in the private sector. The State Government offers a piece of land to LPHP, after which LPHP selects a private developer to develop the land. Land availability and land costs are important factors in the realisation of affordable houses. When land is scare, and land prices are high, this drives up the housing prices. In Ipoh and Manjung for example, land prices are higher. By offering 'free land' with low premiums to developers, we (the government) stimulate developers to build more houses for low prices. Sometimes we (LPHP) get some houses in return, which we can sell to make some profits.

The township project BBSAP (in Lumut-Sitiawan)

For the development of the BBSAP project, Sitia Awan Holdings needed approval (the development order) from the local authority (Manjung District Council). Such a large project exists of multiple phases. LPHP works closely together with the developer for the realisation of the project. The project meets both conditions explained before: larger than 20 acres and over 300 units. Based on this, they are obligated to include the different categories of affordable houses in their project. Interestingly, however, is that the State Government offers a 'special deal' to Sitia Awan Holdings: they are allowed to develop only category 3 houses: they don't need to develop the 10% low cost and 20% medium-cost houses. The reason that the State Government offer them this special 'deal' has to do with the remote location of the project: the developer needs to invest in new infrastructure connections to make the township accessible. Therefore, the State Government allows for this alternative financial construction, which creates higher profits for the developer. This way, the government does not need to support Sitia Awan Holdings financially for the construction of infrastructure.

Drivers behind low-density property development

The reason why not much high-rise developments are found in this area is because of two main reasons. First because of the land availability; second because of the preferences of people. People in Ipoh prefer landed houses over high-rise, even when the high-rise buildings are located in the centre of the city and the landed houses are located on the borders. We do have problems with some high-rise developments of PR1MA in Ipoh because it is difficult to sell the units.

State Structural Plans and Local Plans

Local plans are made by local authorities, which offer information about where you can build. Also, it includes the type of developments that are allowed, for example, high-rise or landed houses. The local plan states what you can- and cannot do (restrictions). If differs from the State Structural Plan, as the Structure plan is more policy-related, and local plans are guidelines about what you can develop.

When a developer wants to build on a certain piece of land, it needs to make sure that the land use of his development corresponds with the local plans. If not, they need to change the land use status, a process called re-zoning (for example from agricultural to residential status). This process takes about six months, to change the zoning. If you want to change zoning plans, you don't need detailed building plans: you can just apply. The State makes the final decision.