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Understanding peri-urban growth in Greater Cairo: A thematic literature synthesis (1990-2025)

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Abstract

Peri-urban areas in the Global South are expanding rapidly under the pressure of demographic change, sociopolitical dynamics, and economic development. Yet, in Greater Cairo, where peri-urbanisation has accelerated since the 1990s, hardly any systematic research has examined its dynamics, leaving planners and policymakers with insufficient evidence to address emerging challenges. This study addresses the limited understanding of peri-urban typologies, by exploring their drivers, challenges, prospects, and transformations through a structured literature review, thematic synthesis, and content analysis of 39 publications (1990-2025). The analysis identifies three peri-urban typologies shaped by location, core-periphery relations, and rural-urban transitions. Expansion was driven by factors such as population growth, flat topography prone to encroachment, road accessibility, unequal job distribution, limited low-income housing, and weak land management. Consequences included agricultural land loss, deteriorating air quality, poverty, unemployment, inadequate infrastructure, severe health risks, and informal land tenure. At the same time, peri-urban areas also hold potential for food production, ecosystem services, economic diversification, and social cohesion. By highlighting these interlinked dynamics, the study provides a framework for understanding peri-urban change in Greater Cairo and calls for future research on resilience capacities to guide more adaptive planning and policy responses.

Keywords: Urban expansion, peri-urban areas, Greater Cairo Region, metropolitan area, thematic synthesis, content analysis

PERI-STEDELIKE GROEI IN GROOT-KAÏRO: 'N TEMATIESE LITERATUURSINTESE (1990-2025)

Peri-stedelike gebiede in die Globale Suide brei vinnig uit onder die druk van demografiese verandering, sosio-politieke dinamika en ekonomiese ontwikkeling. In Groot-Kaïro, waar peri-urbanisasie sedert die 1990's versnel het, bestaan daar egter min sistematiese navorsing oor die aard en dryfvere van hierdie groei. Gevolglik beskik beplanners en beleidmakers oor onvoldoende bewyse om die toenemende uitdagings effektief aan te spreek. Hierdie studie spreek die beperkte begrip van peri-stedelike tipologieë aan deur hul drywers, uitdagings, vooruitsigte en transformasies te ondersoek deur middel van 'n gestruktureerde literatuuroorsig, tematiese sintese en inhoudsanalise van 39 publikasies (1990-2025). Die analise identifiseer drie peri-stedelike tipologieë wat gevorm word deur ligging, kern-periferie-verhoudings en landelik-stedelike oorgange. Uitbreiding is gedryf deur faktore soos bevolkingsgroei, plat topografie wat geneig is tot indringing, padtoeganklikheid, ongelyke werkverdeling, beperkte lae-inkomstebehuising en swak grondbestuur. Gevolge sluit in die verlies van landbougrond, verswakkende luggehalte, armoede, werkloosheid, onvoldoende infrastruktuur, ernstige gesondheidsrisiko's en informele grondbesit. Terselfdertyd toon peri-stedelike gebiede potensiaal vir voedselproduksie, ekosisteemdienste, ekonomiese diversifikasie en sosiale samehorigheid. Deur hierdie verweefde dinamika uit te lig, bied die studie 'n raamwerk vir die begrip van peri-stedelike verandering in Groot-Kaïro en beklemtoon dit die behoefte aan verdere navorsing oor veerkragtigheidsvermoëns om meer aanpasbare beplanning en beleidsreaksies te ondersteun.

LIBAKA TSA PERI-URBAN HO CAIRO E KHOLO: KAKARETSO EA LINGOLILOENG KA SEHLOOHO (1990–2025)

Libaka tsa peri-urban ho Global South li ntse li hola ka potlako tlas'a khatello ea keketseho ea baahi, liphetoho tsa lipolotiki le nts'etsopele ea moruo. Leha peri-urbanization e potlakile ho tloha lilemong tsa bo-1990 ho Cairo e Kholo, ho ntse ho e-na le lipatlisiso tse fokolang tse hlophisitsoeng tse hlalosang mokhoa ona ka botlalo. Sena se siea baralang meralo le ba etsang melao ba se na bopaki bo lekaneng ba ho araba mathata a ntseng a eketseha. Thuto ena e leka ho tlatsa lekhalo lena ka ho hlahloba mefuta ea peri-urban, mabaka a nts'etsopele, mathata, menyetla le liphetoho tse hlahang. Sena se etsoa ka tlhahlobo e hlophisitsoeng ea lingoliloeng, kakaretso ea lihlooho le tlhahlobo ea litaba ho tsoa lingoliloeng tse 39 (1990–2025). Tlhatlhobo e supa mefuta e meraro

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ea peri-urban e thehiloeng sebakeng, likamanong tsa mantlha le tsa kantle, le liphetoho pakeng tsa mahaeng le litoropo. Keketseho e tsamaisoa ke lintlha tse kang kholo e potlakileng ea baahi, sebaka se bataletseng se lumellang ho kenella ka bonngoe, phihlello e ntle ea litsela, kabo e sa lekanang ea mesebetsi, khaello ea matlo a theko e tlaase le taolo e fokolang ea mobu. Liphello li kenyelletsa ho nyamela ha mobu oa temo, ho senyeha ha boleng ba moea, bofutsana, ho hloka mosebetsi, lits'ebeletso tse sa lekaneng, likotsi tse kholo tsa bophelo bo botle le beng ba mobu ba sa ngolisitsoeng. Leha ho le joalo, libaka tsena li boetse li fana ka menyetla ea tlhahiso ea lijo, lits'ebeletso tsa tikoloho, ho fapana ha moruo le ho matlafatsa kopano ea sechaba. Ka ho totobatsa likamano tsena, thuto ena e fana ka moralo oa ho utloisisa liphetoho tsa peri-urban ho Cairo e Kholo le tlhokahalo ea lipatlisiso tse tebileng ka bokhoni ba ho mamella le meralo e ka ikamahang.

1. INTRODUCTION

Currently, over half of the world's population lives in urban areas. Most of this population tends to occur in the Global South, particularly in Asia, Africa and Latin America (Michalina *et al.*, 2021; Stephens & Brown, 2025). This has led to rapid urban expansion of megacities towards fringe areas and peripheries, encroaching on agricultural lands, which is significantly impacting many of the metropolitan areas in the Global South (Schuster-Olbrich *et al.*, 2024). The peri-urbanisation process in the Global South has been commonly related to uncontrolled urban growth, informal development, illegal encroachment on agricultural lands, diverse economic activities, poor infrastructure, and insufficient services (Follmann, 2022; Wolff, Mdemu & Lakes, 2021). Nowadays, peri-urban areas, characterised by rural-urban transformations, have received increased attention. They are experiencing complex changes in demographics, rural-to-urban migration, sociopolitical functions, economic growth, rising land value, mixed land use and inadequate land management (Nuhu, Munuo & Mngumi, 2023; Sahana *et al.*, 2023; Woltjer, 2014). In addition, counter-urbanisation and polarisation reversal processes at the metropolitan scale can cause these transitional zones to grow more rapidly (Rajendran *et al.*, 2024; Wen *et al.*, 2025).

This study focused on the phenomenon of peri-urbanisation in the Greater Cairo Region, the world's seventh-largest metropolitan area and Egypt's economic and administrative capital, which covers 5,020km² and is home to nearly a quarter of the country's population (Salem *et al.*, 2024; Elmazzahi & Shawkat, 2024; CAPMAS, 2024; GOPP *et al.*, 2012). Although prior research addressed urban growth in Greater Cairo's peri-urban areas, there is a crucial need to explore the dynamics of peri-urbanisation in Greater Cairo (Salem, 2024). Therefore, this study aims to examine different peri-urban typologies; identify expansion drivers, challenges and potentials of these peri-urban typologies; determine peri-urbanisation changes, and analyse their causes and effects.

The article presents a conceptual literature review that aims to synthesise the conceptual and empirical insights on peri-urbanisation in the Greater Cairo Region between 1990 and 2025 through a structured literature review, thematic synthesis, and content analysis of 39 publications. This study identifies and interprets five core dimensions of peri-urban dynamics, namely typologies, drivers, challenges, prospects, and transformations to answer the following five questions. What typologies of peri-urban areas have emerged in Greater Cairo? What factors shaped them? What opportunities and threats resulted from their urban expansion? What changes have occurred in these areas? What are the causes and effects of these changes?

The added value to the existing literature lies in critically reviewing urban growth in Greater Cairo's peri-urban areas, by identifying key drivers of expansion, pressing challenges, promising potentials, and several causes and impacts of their transformations. This can help researchers, planners and policymakers propose effective actions and interventions to maintain long-term resilience and sustainable urban planning for Greater Cairo's peri-urban areas.

2. LITERATURE REVIEW

2.1 Definition of peri-urban areas

The phrase 'peri-urban areas' is used alongside several related concepts in the literature, including 'rural-urban fringes', 'rural-urban linkages', 'urban peripheries', 'rurban', 'semi-urban', and urban sprawl' (Follmann, 2022; Sahana *et al.*, 2023). Although peri-urban areas are widely debated in the literature, there is no universal definition for these areas among scholars (Gottero, Larcher & Cassatella, 2023). For instance, Adell (1999) defines peri-urban areas as an interface between the city and the rural areas. Narain and Nischal (2007) point out that these areas could be understood in three different ways, namely as a place, a concept, and a process. The place definition refers to geographical areas where the rural meets the urban. As a concept term, these zones include rural-urban characteristics. The process definition indicates the transitions and flow of goods and services between urban and rural areas.

Follmann (2022) illustrates that peri-urban areas can be categorised by three conceptual vectors, namely territorial, functional, and transitional, in order to make sense of these areas. Thompson *et al.* (2010) demonstrate that islands on the Nile River that combine urban and rural characteristics can be considered peri-urban areas. Owing to their proximity to urban areas, these transitional zones share mixed features of urban and rural environments. Chettry (2022) highlights that the scatter of low-density development along major highways that combine rural-urban characteristics can be considered peri-urban areas. These varying definitions emphasise the complexity of the peri-urban areas across different contexts. Therefore, each metropolitan region should be studied as a distinct context to determine these areas (Salem, 2015).

2.2 Debates about the peri-urbanisation phenomenon

Peri-urbanisation refers to multiple transformations at the urban periphery, leading to the emergence of transitional zones between rural and urban areas (Demiroğlu İzgi, 2024). This phenomenon varies across regions, particularly between the Global North and the Global South (Woltjer, 2014). In the Global North, peri-urbanisation is related to planned growth and low-density housing that is linked with social welfare and well-being, as well as sociocultural shifts that occur as rural dwellers increasingly tend to urban lifestyles. Conversely, peri-urbanisation in the Global South is associated with unplanned and fragmented urban expansion, haphazard development, a mixture of agriculture and non-agriculture activities, insufficient infrastructure services, and middle- to low-income housing with lesser living costs (Allen, 2003; Follmann, 2022; Ravetz & Sahana, 2024).

The rapid urban expansion of peri-urban areas has brought various environmental, physical, social, and economic changes (Varkey & Manasi, 2019; Vishal & Pranay, 2024). These areas face environmental challenges, including the depletion of limited agricultural lands, severe traffic congestion, and air pollution caused by proximity to industrial expansion and lengthy commutes resulting from urban sprawl (Brueckner, 2001; Shen, Wang & Wang, 2024). They are susceptible to impacts of climate change, including heatwave events, irregular precipitation, flooding, elevated sea levels, erosion, landslides, salinisation, desertification, and increased carbon emissions. These impacts increase their fragility, particularly the socio-ecological systems (Matthew *et al.*, 2022). Physical transformations present in the form of fragmentation of the natural landscape and land-use changes as a result of accelerated urban sprawl (Salem, 2024). Furthermore, they suffer from inadequate provision of infrastructure and its services, which is presented in limited access to roads, road quality, availability of public transport, and a lack of services *(*Wolff *et al.*, 2021).

Socio-economically, peri-urban areas are struggling with the reduction of agricultural employment, the rise of land speculation, an increase in informal activities, and shifts in economic activity towards more productive sectors. Moreover, sociocultural pressure in these areas may lead to conflict, as they have the opportunity to attract several actors with various interests and demands (Adam & Dadi, 2024; Allen, 2003; Madrigal-Martínez *et al.*, 2025). These threats affect the capacity of these zones to be resilient, inclusive, productive, and sustainable (Angel, 2023). Peri-urban areas play a crucial role in providing metropolitan regions with peri-urban agriculture, food production, biodiversity, ecosystem services, and diverse economic bases, in addition to improving mental and physical health through natural landscape amenities (Buxton, 2021).

2.3 Peri-urbanisation in Greater Cairo

Peri-urban areas in Greater Cairo have witnessed accelerated urban growth since the 1990s (Sims, 2012). Previous studies addressing these areas could be divided into two categories. The first category includes studies that discussed peri-urban areas implicitly, such as Cities Alliance (2008), Kenawy (2016) and Sim *et al.* (2003) and pointed out peri-urban expansion's causes and impacts through understanding slums in Greater Cairo. Attia (2001) and Soliman *et al.* (2023) illustrate policy aspects of peri-urban expansion during their studies for Greater Cairo's master plans. Aboelnour and Engel (2018) as well as El Araby (2002) show the environmental challenges of urban expansion in peri-urban areas as a part of the Greater Cairo Region.

The second category involves empirical studies on these areas such as Osman, Divigalpitiya and Arima (2016) as well as Salem *et al.* (2018). They analyse key factors of peri-urban expansion. Shalaby *et al.* (2012) and Youssef (2019) examine the impacts of urban sprawl on the agricultural lands in these areas. However, researchers highlight a significant gap in the literature regarding peri-urbanisation dynamics in Greater Cairo, where urban growth is rapid and undergoes chaotic changes over time (Howeidy *et al.*, 2009; Kenawy, 2016; Mosilhi, 2017; Salem, 2024, 2015; Soliman, 2021).

3. METHODS AND REVIEW APPROACH

3.1 Research design

This study adopts a conceptual literature review approach. This approach is employed to interpret and synthesise available knowledge on a certain topic through understanding key themes and relations (Hughes, 2019; Omotayo *et al.*, 2024). The article combines structured document retrieval from 1990 to 2025, with thematic synthesis and content analysis to clarify the four core dimensions related to Greater Cairo's peri-urban typologies, expansion drivers, challenges and potentials, and highlight different peri-urban transformations by interpreting their causes and impacts (Horani, 2023; Jnanathapaswi, 2021; Krippendorff, 2019).

3.2 Searching and selection of literature

The study uses Scopus and Web of Science databases as primary search engines to conduct a comprehensive literature search, encompassing journals, books, and conference proceedings published between 1990 and 2025. The keywords used were identified based on different terminologies related to the peri-urbanisation phenomenon in the Greater Cairo Region such as peri-urban areas (urban periphery, rurban, semi-urban, urban sprawl, and rural-urban linkage), urban expansion (informal growth and urbanisation), causes and effects of peri-urbanisation (drivers, challenges, and potentials), and the context (Greater Cairo Region and Egypt). The search used these keywords with multiple search queries to broaden the scope of the results. The search string was performed with article title, abstract

and keywords in Scopus and with topic in Web of Science as follows:

- (peri-urban) OR (urban AND periphery) OR (urban AND sprawl) OR (semi-urban) OR (rurban) AND (Greater AND Cairo AND Region).
- (peri-urban) OR (urban AND expansion) AND (Greater AND Cairo AND Region).
- (peri-urban) AND (urban AND expansion) AND (Greater AND Cairo AND Region).
- (drivers) OR (challenges) OR (potentials) AND (urbanization) AND (Greater AND Cairo AND Region).
- (informal AND growth) AND (Greater AND Cairo AND Region).
- (rural-urban AND linkage) AND (Greater AND Cairo AND Region) OR (Egypt).

The search yielded 42 and 35 documents from Scopus and Web of Science databases, respectively.

In addition, Google Scholar was used to investigate publications that were not included by previous databases such as academic theses, reports of foreign development agencies, governmental reports, books, and other articles in the Arabic language. This decision was made as the number of documents from two databases (Scopus and Web of Science) was limited. The queries used in the search string were:

- allintitle: Greater Cairo Region “urban OR sprawl” OR “Peri-urban” OR “periphery OR urban” OR “Semi-urban” OR “rurban”.
- allintitle: Greater Cairo Region Urban OR Expansion “Peri-urban”.
- allintitle: Greater Cairo Region “informal growth”.

This search elicited 81 documents. The search phase was initially done from August to October 2024, then revisited in March 2025 with a total of 158 publications across the three databases. These total records were manually scanned to avoid redundancy of documents. After removing 72 duplicates, the remaining 86 documents were screened by their titles and abstract. The exclusion criterion was based on the irrelevant scope of the publications such as sustainable development of urban areas, mobility interventions, and urban energy infrastructure. This resulted in 33 documents. These documents went through forwards/backwards snowballing with Google Scholar database to include publications that did not appear in the search string of the selected databases. 22 documents were added from snowballing to the review process. A total of 55 documents were screened, by reading the publication sections that included keywords that were identified at the beginning of this literature search related to peri-urbanisation in the Greater Cairo Region to reach a final decision for eligibility. 15 documents were excluded, due to inaccessibility to full text as well as one record discussing urban areas only in Greater Cairo. Finally, the screening and selection phase elicited 39 documents. The literature search process followed PRISMA protocol (Page *et al.*, 2021), as shown in Figure1.

3.3 Thematic synthesis and content analysis

The selected 39 publications from reviewing the literature went through thematic synthesis and qualitative content analysis. This process included six phases adapted from Jnanathapaswi (2021); Krippendorff (2019); Naeem *et al.* (2023), as well as Thomas and Harden (2008): Familiarising data, identifying keywords, generating codes, determining themes, reporting themes, conceptualisation.

Familiarising data: This phase depended on reading full-text documents and taking preliminary notes to determine important sections related to the peri-urbanisation phenomenon in the Greater Cairo Region.

Identifying keywords: In this phase, data was reread carefully to determine keywords used in the selected literature related to peri-urbanisation in Greater Cairo, such as “peri-urban areas”, “rural-urban”, “urban sprawl”, “reclaimed desert”, “rurban”, “urban expansion”, “informal growth”, “driving factors”, “driving forces”, “environmental degradation”, “poverty”, “unemployment”, “health problems”, “food production”, “diverse activities”, and “sense of community”.

Generating codes: In the third phase, line-by-line coding with different gradient colours was assigned according to the identified keywords in the previous phase, with regarding research

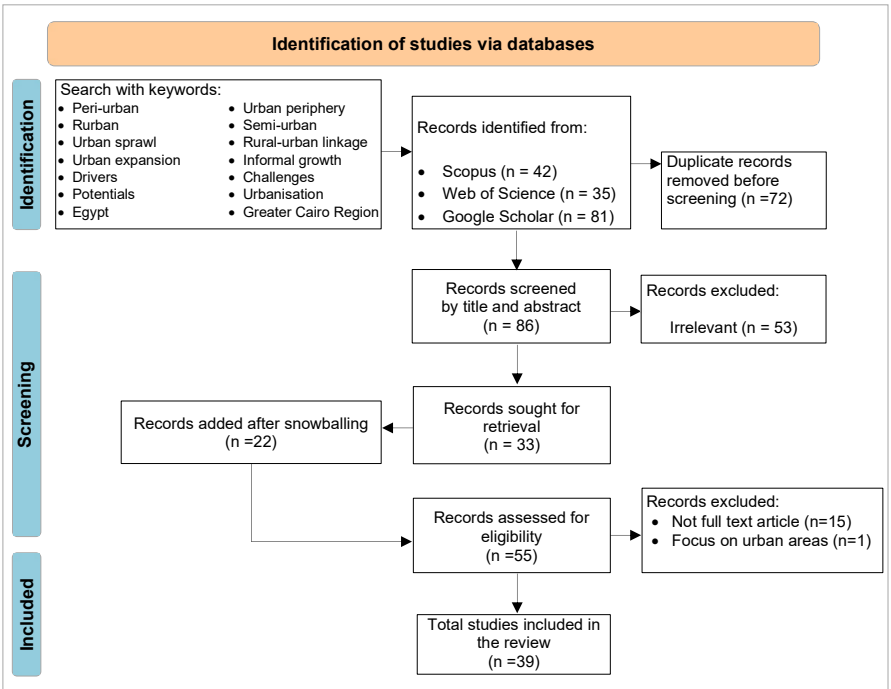

Figure 1: PRISMA flowchart with results of each review stage

Source: Adapted from (Page *et al.*, 2021)

questions related to Greater Cairo's peri-urban typologies, factors of expansion, opportunities, and threats. These codes were then organised and grouped into categories. In parallel, Excel sheets were used to count the number of documents in each category.

Determining themes: This phase included generating four themes based on codes and categories, as shown in Table 1.

The first theme was "Typologies of peri-urban areas" which derived from the codes: "peri-urban", "rurban", " urban sprawl", "rural-urban", "reclaimed desert", "rural islands", "informal growth", "reclaimed desert", and "urban expansion" into the following categories: Type A: Peri-urban areas in Giza and Qalyubiya; Type B: Peri-urban areas on the Nile islands, and Type C: Peri-urban areas on the reclaimed desert. The second theme was "Drivers of urban expansion in peri-urban areas", which arose from organising several codes such as "topography", "accessibility", "population density", "agriculture", "fishing", "low-income housing", and "governmental capacity" into the following categories: "physical factors", "accessibility and proximity factors", "demographic factors", "economic factors", "housing demand and supply", and "legal and policy factors". The third theme was "Challenges of peri-urban expansion", extracted from the arrangement of codes such as "heat island effect", "air pollution", " poor people", "unemployment", "sanitation", and "land property" into these categories: "environmental challenges", "poverty", "economic challenges", "infrastructure and basic services challenges", "health challenges", and "land tenure challenges". The fourth theme was "Potentials of peri-urban areas", which resulted from sorting multiple codes such as "food security", "agricultural livelihoods", "diverse activities", "job opportunities", and "sense of community" into the following categories: "food production and ecosystem services", "economic diversity", and "social cohesion".

Reporting themes: The fifth phase answered the research questions related to Greater Cairo's peri-urban typologies, urban expansion drivers, challenges, and potentials. The first theme of Greater Cairo's peri-urban typologies was described and synthesised with a frequency chart and spatially allocated the examples of these typologies with the number of documents on a map. The other three themes of expansion drivers, challenges, and potentials were explained and correlated with frequency charts, considering devised typologies of peri-urban areas.

Conceptualisation: In this phase, the four themes were analysed in detail through qualitative content analysis to answer the question related to transformations that have emerged in Greater Cairo's peri-urban areas through building a conceptual model. In addition, two analytical matrices were constructed to answer the question related to the causes and impacts of each transformation in peri-urban typologies, by correlating these transformations with drivers of urban expansion, challenges, and potential themes, using previous coded patterns.

4. RESULTS

The thematic synthesis and content analysis of 39 reviewed records yielded four themes, namely typologies of peri-urban areas, drivers of urban expansion in different peri-urban types, and the challenges, and prospects across the different devised typologies. These themes aim to explore Greater Cairo's peri-urban types and identify their expansion key factors, challenges, and potentials.

4.1 THEME 1: Typologies of peri-urban areas

Three types of peri-urban areas in Greater Cairo have been extracted from the reviewed documents. These types are determined based on their location around the city, the nature of the core, and periphery relations that provide the region with environmental resources, ecosystem services, goods, and labour, in addition to the nature of the transitions between the urban and rural areas resulting from urban growth at the peripheries. They are classified as:

Type A: Peri-urban areas in Giza and Qalyubiya: Out of 39 reviewed publications, 32 discussed this

Table 1: Summary of themes identified during the document review phase

Themes	Categories	Codes (keywords) extracted from reviewed documents
Typologies of peri-urban areas	Type A: Peri-urban areas in Giza and Qalyubiya	Peri-urban areas, urban expansion, urban sprawl, transitional zones
	Type B: Peri-urban areas on the Nile islands	Rural islands, peri-urban areas, informal growth
	Type C: Peri-urban areas on the reclaimed desert	Urban sprawl, reclaimed desert, land reclamation
Drivers of urban expansion in peri-urban areas	Physical factors	Urban centres, topography, Nile River
	Accessibility and proximity factors	Connectivity, distance, roads, railways, transportation, regional services
	Demographic factors	Population growth, population density, increase of population
	Economic factors	Economic activities, job opportunities, agriculture, industry, fishing
	Housing demand and supply	Housing market, real-estate market, rent-control laws, low-income housing
	Legal and policy factors	Laws, decrees, governmental policy
Challenges of peri-urban expansion	Environmental challenges	Loss of agricultural lands, heat island effect, air pollution
	Poverty	Poor people, poverty line
	Economic challenges	Unemployment, financial returns
	Infrastructure and basic services challenges	Sanitation, electricity, water, solid waste
	Health challenges	Physician density, death rate
	Land-tenure challenges	Land property, registration, contracts
Potentials of peri-urban areas	Food production and ecosystem services	Food security, agricultural livelihoods, ecosystem
	Economic diversity	Urban development, diverse activities, job opportunities
	Social cohesion	Sense of community, social interaction, cooperation

typology, as shown in Figure 2. The type refers to the rural-urban zone between the city and the rural areas. It includes satellite villages and towns that exist on the arable lands in the north and south surrounding Greater Cairo's main agglomeration in Giza and Qalyubiya Governorates (Sims, 2012; World Bank, 2008), as represented spatially with the number of documents in each example in Figure 3. These areas occupy 35% of the Greater Cairo Region and their urban growth is polycentric, as settlements expand informally outwards into agricultural lands (Salem & Tsurusaki, 2024).

Type B: Peri-urban areas on the Nile islands: Figure 2 illustrates that 13 out of 39 reviewed documents pointed to this typology. For instance, the World Bank (2008) emphasised that Waraq Island on the Nile should be a peri-urban area, as it has rural-urban characteristics. Zayed (2017) and Gerlach (2009) also demonstrate that the Nile islands such as Waraq, Dahab, and Al-Qorsaya are rural islands with informal settlements. Out of 13 reviewed documents, four showed examples of this type spatially, as shown in Figure 3.

Type C: Peri-urban areas on the reclaimed desert: This typology refers to urban expansion on the reclaimed desert as a scattered low-density development along major highways that shares rural-urban features. Out of 39 reviewed records, six indicated this type, as shown in Figure 2. Desert lands in the east and the west of Greater Cairo were transformed into reclaimed agricultural lands. These areas are largely found in Ahmed Orabi Agricultural Cooperative Association in the east and along the Cairo-Alexandria desert road in the west (Salem *et al.*, 2020a, 2020b). These lands contain low-density built-up areas such as compounds, private villas, and touristic villages (Sims, 2012). Out of six reviewed records, three covered the spatial distribution of this type's examples in Figure 3.

4.2 THEME 2: Drivers of urban expansion in peri-urban areas

Peri-urbanisation is characterised by a dynamic process involving multiple key factors and interrelations that play different roles and affect each other directly or indirectly (Salem *et al.*, 2019). Based on the previous studies, several drivers contribute to urban growth across the varying peri-urban typologies in Greater Cairo. They can be classified into physical, accessibility and proximity, demographic, economic, housing demand and supply, as well as legal and policy factors (see Figure 4).

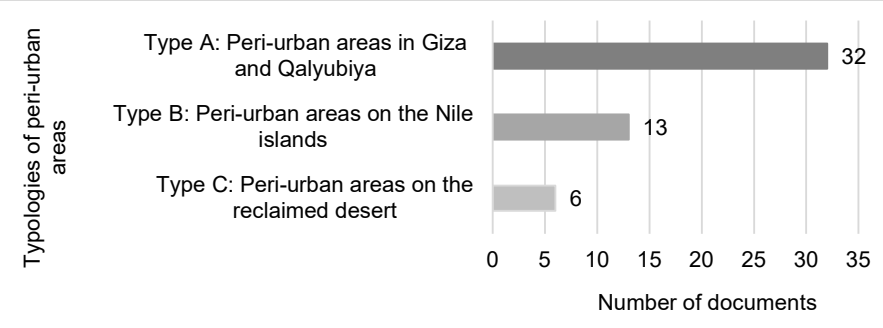

Figure 2: Frequency of Greater Cairo's peri-urban typologies in the reviewed documents
Source: Authors

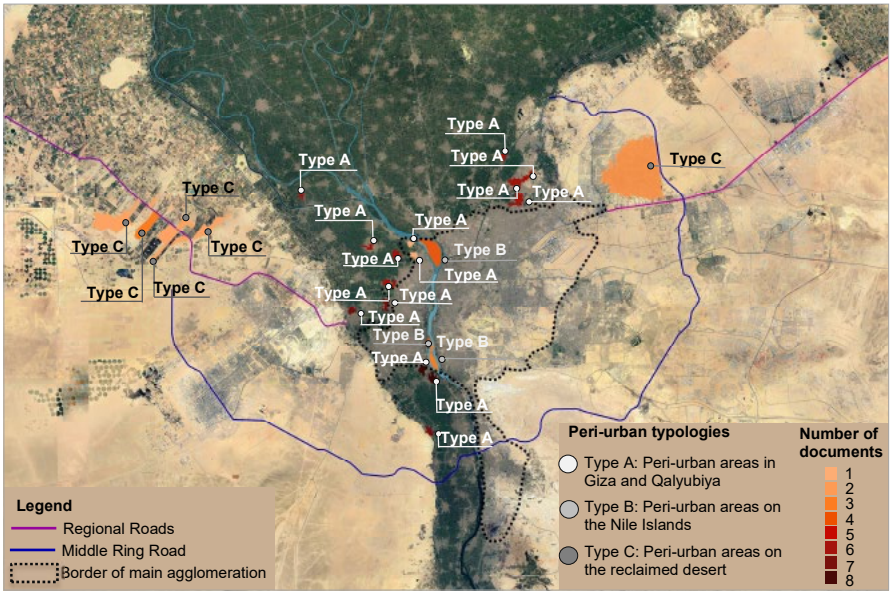

Figure 3: Spatial allocations and frequency of documents on the three peri-urban typologies in Greater Cairo
Source: Authors

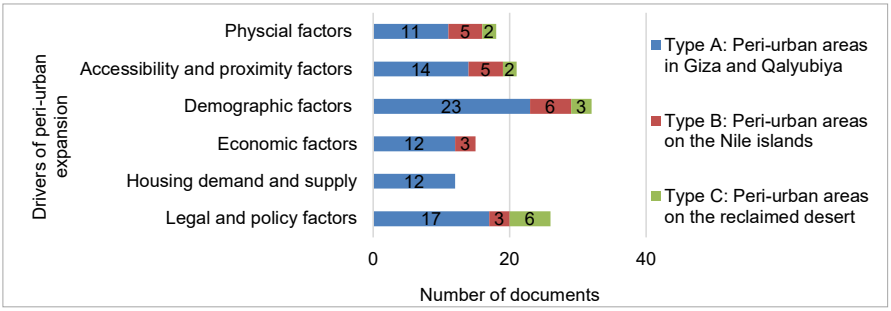

Figure 4: Frequency of urban expansion drivers in the reviewed documents (by peri-urban typology)
Source: Authors

Physical factors: 18 documents covered physical aspects that affect the urban growth of peri-urban typologies in Greater Cairo. 11 records discussed physical factors in peri-urban areas in Giza and Qalyubiya (Type A), while five records illustrated these physical drivers in peri-urban areas on the Nile islands (Type B), as shown in Figure 4. These physical aspects varied between local urban centres, neighbourhood factors, topography, and the Nile River (Badwi *et al.*, 2022; Megahed *et al.*, 2015; Osman *et al.*, 2018). Neighbourhood factors were the main significant physical aspects of peri-urban expansion in Giza on the adjacent arable lands from 2004-2013, due to the tendency of migrant residents to expand near developed areas (Osman, 2016). A wide plain topography in the north and north-east of Greater Cairo encouraged urban expansion on agricultural lands (Hereher, 2012). However, narrow arable lands in the south caused limited urban expansion of peri-urban settlements (Salem *et al.*, 2018). Only two documents highlight land-cover changes from desert into reclaimed agricultural lands as a main physical factor of urban expansion in peri-urban areas on the reclaimed desert (Type C) (Megahed *et al.*, 2015; Salem *et al.*, 2020a).

Accessibility and proximity factors: The existence of regional roads, railways, public transportation, proximity of services, and urban centres led to urban expansion in different peri-urban typologies in Greater Cairo in 21 of the reviewed documents (Figure 4). 14 studies covered these factors in peri-urban areas in Giza and Qalyubiya (Type A), five studies demonstrated accessibility factors in peri-urban areas on the Nile islands (Type B), and the remaining two studies discussed these aspects in peri-urban areas on the reclaimed desert (Type C). For example, proximity to urban centres and roads was a significant driving factor of urban expansion in peri-urban areas in Giza and Qalyubiya (Type A) (Denis & Séjourné, 2002; Osman, 2016; Salem *et al.*, 2019, 2018, 2017; World Bank, 2008). These newly informal expanded settlements emerged near the existing urban areas, benefiting from the existing infrastructure, services, and facilities (Megahed *et al.*, 2015). In addition, Zayed (2017) points out that accelerated urbanisation on the Nile islands occurred because of the easy accessibility to these islands (Type B). Mosilhi (2017) and Salem *et al.* (2020a) emphasise that the Cairo-Alexandria Desert Road and the Cairo-Ismailia Road encouraged formal peri-urban growth on the reclaimed eastern and western deserts (Type C).

Demographic factors: A total of 32 studies discussed demographic factors in all peri-urban typologies in Greater Cairo. Figure 4 shows that 23 records illustrate demographic divers of urban expansion in peri-urban areas in Giza and Qalyubiya (Type A). These studies emphasise that rapid urban growth is the key factor of the peri-urbanisation phenomenon in Greater Cairo (Cities Alliance 2008; JICA, 2008; MHUUC, 2016). Salem *et al.* (2019) argue that the average annual population growth rate of these areas is 3% and total population exceeded approximately 5 million recently. In addition, population density varied from 161 to 275 person/feddan in 2017. These values are high compared to Egyptian standards of density in urban and rural areas (Salem *et al.*, 2020d). Demographic factors were included in six studies for peri-urban areas on the Nile island (Type B) in Figure 4. The study of Osman (2016) shows empirically the population density increase in these areas, due to urban-rural and rural-urban migrations (Mosilhi, 2017; Sims, 2012). Population change in peri-urban areas on the reclaimed desert (Type C) were included in the three reviewed documents (Figure 4), as a result of governmental policies that aim to redistribute overcrowding populations, by implementing urban development in the desert lands (Attia, 2001; Gouda *et al.*, 2016; Soliman *et al.*, 2023).

Economic factors: Several economic activities drove rapid urban expansion in the two types of peri-urban areas (Types A and B). This was pointed out in 12 documents related to peri-urban areas in Giza and Qalyubiya (Type A) and three documents related to peri-urban areas on the Nile islands (Type B) in Figure 4. These economic activities varied between agriculture, industry, fishing, and transport (Howeidy *et al.*, 2009; Salem *et al.*, 2018; World Bank, 2008). Moreover, seeking job opportunities and getting benefits from different facilities and services in Greater Cairo's urban core was a factor that drove migration from rural areas to the surrounding Cairo's main agglomeration (Type A). This led some migrants to buy their lands and build informal settlements on agricultural lands in the north and west where the land price was cheap (Sims, 2012).

Housing demand and supply: This factor was discussed only in peri-urban areas in Giza and Qalyubiya (Type A) in 12 publications (Figure 4). Prior studies emphasise that these areas have a vibrant housing market. From the 1960s, affordable housing for low-income residents was limited, encouraging farmers to subdivide their agricultural lands and sell them for residential uses. These lands became ten times more expensive than the price for agricultural lands (Sims, 2012). In addition, the private sector did not investigate the low-income housing supply (Kenawy, 2016). The demand for informal housing from newly married families and migrants became high in the illegal expansions on arable lands because of rent control laws and high value of legal real-estate market (El-Batran & Arandel, 1998; Howeidy *et al.*, 2009). The World Bank (2008) argues that housing demand at the peripheries is higher than that surrounding Cairo's main agglomeration, due to less control from the government to prohibit building on arable land in these areas.

Legal and policy factors: 26 documents highlighted legal and policy factors that affect urban growth in all peri-urban typologies in Greater Cairo. 17 documents covered these factors in peri-urban areas in Giza and Qalyubiya (Type

A) and three documents illustrated this factor in peri-urban areas on the Nile islands (Type B), as illustrated in Figure 4. The Egyptian government issued a series of laws and decrees to control informal urban growth and conserve agricultural lands such as Planning Law no. 3/1982, Agriculture Land Protection Law no. 116/1983, Betterment Taxes Law no. 222/1995, Prime Minister decree no. 1, 2/1996, and Unified Building Law no. 119/2008 regarding implementing the urban growth boundary (Tahzim). These legislations could not regulate and manage the illegal encroachments on agricultural lands (Cities Alliance, 2008; Denis & Séjourné, 2002; MHUUC, 2016; Nada, 2014; Salem & Tsurusaki, 2024; World Bank, 2008). Nada (2014) argues that the lack of governmental capacity to implement these policies returns to centralisation of governance, weak coordination between different authorities, ambiguity around the law's interpretation and the efficacy of accountability systems. Conversely, the governmental policy of establishing new communities in the desert encouraged formal scattered expansions on peri-urban areas on the reclaimed deserts (Type C) (Attia, 2001; Mosilhi, 2017; TADAMUN, 2016). This was discussed in six documents (Figure 4).

4.3 THEME 3: Challenges of peri-urban expansion

Peri-urban expansion in Greater Cairo causes several interrelated challenges that were discussed in prior studies. They vary between environmental, poverty, economic, infrastructure and basic services, health, and land tenure challenges (see Figure 5).

Environmental challenges: Peri-urban expansion in Greater Cairo causes environmental degradation in all peri-urban typologies. Figure 5 illustrates that 31 and 13 overlapping studies discussed environmental challenges in peri-urban areas in Giza and Qalyubiya (Type A) and peri-urban areas on the Nile islands (Type B). The empirical study of Salem and Tsurusaki (2024) shows that loss of arable lands at the peripheries exceeded 51 thousand hectares between 2001-2021. These encroachments on agricultural lands influence land fertility, soil quality, crop productivity, and food security. The extension of these areas leads to heat island effect, due to land-use and land-cover change, in addition to increasing greenhouse gas and air pollution, because of traffic congestion and the consumption of fuels on roads (Aboelnour & Engel, 2018; El Araby, 2002; JICA, 2008; Osman *et al.*, 2016; Salem & Tsurusaki, 2024; Youssef, 2019). Only three documents highlight environmental challenges in peri-urban areas on the reclaimed desert (Type C). El Araby (2002) argues that these areas are exposed to air pollution because of their proximity to the industrial zone in Obour city. Reclaimed deserts need additional efforts to achieve food productivity (Salem *et al.*, 2020a, 2020b).

Poverty: A total of ten records discussed this challenge in peri-urban areas in Giza and Qalyubiya (Type A) and on the Nile islands (Type B), as shown in Figure 5. Sabry (2010) emphasises that informal peri-urban types suffer from poverty in the Greater Cairo Region. Salem *et al*.(2020d) demonstrate that the average rate of the poor in satellite peri-urban areas has increased from 17% in 1996 to 40% in 2006 and 39% in 2017. These areas are notably poorer when compared to the rate of the poor in Greater Cairo's main agglomeration (20% in 2006). Sims *et al.* (2003) argue that satellite hamlets have a higher percentage of poor people than larger village agglomerations. In addition, Tadamun (2016) illustrate that the percentage of the poor in peri-urban islands (Type B) was between 35%-50% in Waraq and between 20%-35% in Dahab and Al-Qorsaya in 2006.

Economic challenges: Economic problems resulting from rapid urban expansion were covered in ten documents related to peri-urban areas in Giza and Qalyubiya (Type A) and one document related to peri-urban areas on the Nile islands (Type B), as shown in Figure 5. The study of Salem *et al*.(2020d) illustrates that the average rate of unemployment has increased from 6.7% in 1996 to 8.5% in 2006, rising to 12.5% in 2017 in the peripheral municipalities, because of the decline of agricultural activity in these areas (Cities Alliance, 2008). The financial returns from arable lands decrease, due to land fragmentation that increases land value for non-agriculture activities. This decreases job opportunities in the agriculture sector. Moreover, the degradation of agricultural lands affects the food production (Salem & Tsurusaki, 2024; Youssef, 2019; Shalaby *et al.*, 2012).

Infrastructure and basic services challenges: 13 records demonstrated infrastructure and basic services challenges in peri-urban areas in Giza and Qalyubiya (Type A), while two records focused on this challenge in peri-urban areas on the Nile islands (Type B) in Figure 5. The study of Salem *et al.* (2020c) shows that most of Greater Cairo's peri-urban areas at the peripheries (Type A) have access to the water network in the official census.

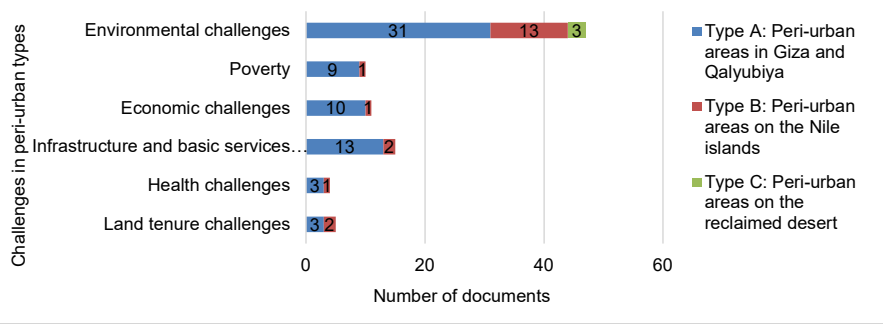

Figure 5: Frequency of challenges in the reviewed documents (by peri-urban typology)

Source: Authors

However, Tadamun (2016) points out that the majority of these areas suffer from a lack of affordable good quality water, while Waraq peri-urban island (Type B) does not have access to a water network. 46.6% of the houses in these areas do not have access to sanitation networks, according to the census of 2017 (Salem *et al.*, 2020c). Householders use trenches that do not connect to sanitation networks. Sewage from trenches spills into groundwater, polluting water supply as the pipes' condition is poor (Tadamun, 2016). The World Bank (2008) illustrates that solid waste in these areas is dumped in the irrigation canals and drains, due to the absence of solid waste-collection systems. Likewise, Soliman (2021) highlights that peri-urban settlements on the fringe and surrounding urban agglomeration suffer from lack of basic services.

Health challenges: Health problems were illustrated in peri-urban areas in Giza and Qalyubiya (Type A) in three documents and in peri-urban areas on the Nile islands (Type B) in one document, as shown in Figure 5. Mosilhi (2017) and Sims *et al.* (2003) emphasise that the poor of these areas are significantly vulnerable to health challenges such as diseases, drug abuse, and death rate. The studies of Salem *et al.* (2020c) and Salem *et al.* (2020d) focus on physician density and under-5 mortality rate in satellite peri-urban areas in the north and south of the region. Their results show that physician density was very low (0.5 physician per 1,000 persons) compared to the main urban agglomeration (1.3 physician per 1,000 persons) and The World Health Organization standards (2.5 physicians per 1,000 persons). In contrast, the average under-5 mortality rate in these areas was 26.7 in 2003 and 15.9 in 2010. These rates were better than the rates of the main agglomeration, which were 24.3, and 22.4 in 2003 and 2010, respectively.

Land tenure challenges: Three documents discussed land tenure challenges in peri-urban areas in Giza and Qalyubiya (Type A) and two documents illustrated this challenge in peri-urban areas on the Nile islands (Type B) in Figure 5. The World Bank (2008) and Nada (2014) highlight that land property of arable lands in most of the peripheral peri-urban areas (Type A) has been carried out through informal contracts without registration in the real-estate registry. The registration system seems complex for applicants as a clear chain of title is necessary from the last time the property was recorded in the registry (Sims, 2012). This makes legal subdivisions and building permits difficult. Informal peri-urban settlements on the Nile islands (Type B) constantly face land property pressures related to their high land values (Howeidy *et al.*, 2009; Zayed, 2017).

4.4 THEME 4: Potentials of peri-urban areas

Previous studies discussed significant potential in Greater Cairo's peri-urban areas that vary between food production, ecosystem services, economic diversity, and social cohesion (see Figure 6).

Food production and ecosystem services: Five documents covered food production and ecosystem services as a prospect in peri-urban areas in Giza and Qalyubiya (Type A) in Figure 6. These areas are considered a provider for food and livestock production that contributes to food security in the region (MHUUC, 2016; Salem *et al.*, 2017; Shalaby *et al.*, 2012). The products of these areas meet residents' needs, and the remainder is exported to other areas (Youssef, 2019). Salheen and Attia (2003) argue that the ecosystem of these areas can help reduce air pollution and that solid waste can be used as fertiliser for agricultural practices. Moreover, one document highlighted that the converted deserts to reclaimed agricultural lands offer additional sources of food production and agricultural livelihoods in peri-urban areas on the reclaimed desert (Type C)(Salem *et al.*, 2020b).

Economic diversity: Six overlapped documents in Figure 6 pointed out that the economic sector is characterised by diverse activities that vary between agriculture, fishing, construction, commerce, and transport, thus attracting migration to peri-urban areas in Giza and Qalyubiya (Type A) as well as peri-urban areas on the Nile islands (Type B) (Howeidy *et al.*, 2009; Osman, 2016; The World Bank, 2008). In addition, the existence of factories near agricultural areas, especially in Shubra El-Khiema and El Kanka, encourages manufacturing activity in peri-urban areas in Qalyubiya (Type A) (Shalaby *et al.*, 2012). One document points out that urban development of the reclaimed desert offers job opportunities in peri-urban areas on the reclaimed desert (Type C), as shown in Figure 6 (Sims, 2012).

Social cohesion: Two documents highlighted this prospect in peri-urban areas in Giza and Qalyubiya (Type A), while one document expressed social cohesion in peri-urban areas on the Nile islands (Type B) in Figure 6. Residents of peri-urban areas in Giza and Qalyubiya (Type A) have a strong sense of community as they tend to know each other, work in social groups, cooperate,

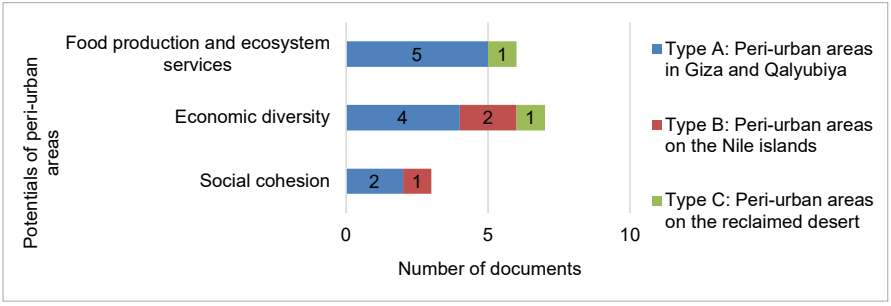

Figure 6: Frequency of prospects in the reviewed documents (by peri-urban typology)

Source: Authors

build friendly relationships with strangers, and interact together with a sense of belonging to their community (Sims, 2012; The World Bank, 2008). In addition, residents of peri-urban areas on the Nile islands (Type C) tend to join efforts to resist any attempts to evict them from their lands, as evident in the case of Al-Qorsaya Island (Howeidy *et al.*, 2009).

5. DISCUSSION

5.1 Dynamics of peri-urbanisation in Greater Cairo

The study identifies peri-urban transformations in Greater Cairo through analysing four themes of typologies, drivers of urban expansion, challenges and potentials. They are categorised into demographic, socio-economic, physical, environmental and land tenure transformations, as shown in Figure 7. These different transformations are interpreted through analysing key factors that cause changes in these areas depending on drivers of expansion theme in the reviewed documents, as shown in Table 2. Increase in the population growth in informal peri-urban areas in Giza and Qalyubiya (Type A) and on the Nile islands (Type B) occurred in eight documents owing to rural-to-urban and urban-to-rural migrations seeking job opportunities in different economic activities (Howeidy *et al.*, 2009; MHUUC, 2016; Mosilhi, 2017; The World Bank, 2008). Demographic shifts on the reclaimed desert peri-urban areas (Type C) took place because of governmental policy to redistribute population growth in the eastern and western deserts (Megahed *et al.*, 2015; Shalaby *et al.*, 2012). This was illustrated in five documents.

Socio-economic changes in the informal peri-urban typologies in Giza and Qalyubiya (Type A) and on the Nile islands (Type B) have emerged in the form of a decline in agricultural activities (five documents), owing to land-use and land-cover change, subdivision of agricultural lands, shifting to non-agricultural activities, rural-urban migration, and inadequate land management (Osman *et al.*, 2016; Sims, 2012; Soliman, 2021). The decrease in the percentage of agricultural workers (seven documents) occurred because of the subdivision of agricultural lands from landowners and farmers' tendency toward more productive activities (Salem, 2015; Youssef, 2019). Moreover, high land demand for informal housing in peri-urban areas in Giza and Qalyubiya (Type A) were discussed in seven documents. This demand aggravated these pressures, as migrants could not afford to buy or rent formal residential units, due to the unaffordability of the formal real estate (Howeidy *et al.*, 2009; Sims, 2012). Thus, it is important to consider these demographic and socio-economic shifts during strategic planning and management of these areas.

Physical transformations in peri-urban areas in Giza and Qalyubiya (Type A) and on the Nile islands (Type B) have occurred in the form of informal expansion, owing to their flat topography, and higher accessibility and proximity factors (Badwi *et al.*, 2022; Hereher, 2012; Osman, 2016), in addition to the government's inability to implement laws and decrees that control encroachments on agricultural lands (Cities Alliance, 2008). This was discussed in 33 documents. Fragmentation of agricultural lands was also covered in five documents. This shift took place in peri-urban areas in Giza and Qalyubiya (Type A), because of the subdivision of these arable lands in the absence of legislation enforcement (Salem *et al.*, 2020b; Shalaby *et al.*, 2012). Moreover, three documents proved that the shortage of solid waste management led to the dumping of waste in irrigation canals and drains in peri-urban areas in Giza and Qalyubiya (Type A) (Denis & Séjourné, 2002; World Bank, 2008; Youssef, 2019). Therefore, these physical changes need effective land-management strategies and wastewater-treatment practices.

Scattered urban expansion on the reclaimed desert peri-urban areas (Type C) took place, due to policy factors on redirecting urbanisation away from the urban core and surrounding arable lands (Attia, 2001; Soliman *et al.*, 2023). This was included in eight documents (Table 2). Land-use and land-cover change, shifting to non-agricultural activities and proximity to roads, and transportation are the main key drivers that led to environmental shifts in peri-urban areas in Giza and Qalyubiya (Type A) and on the Nile islands (Type B), including loss of agricultural lands (24 records) and change in air quality (three records). Peri-urban areas on the reclaimed desert (Type C) were exposed to

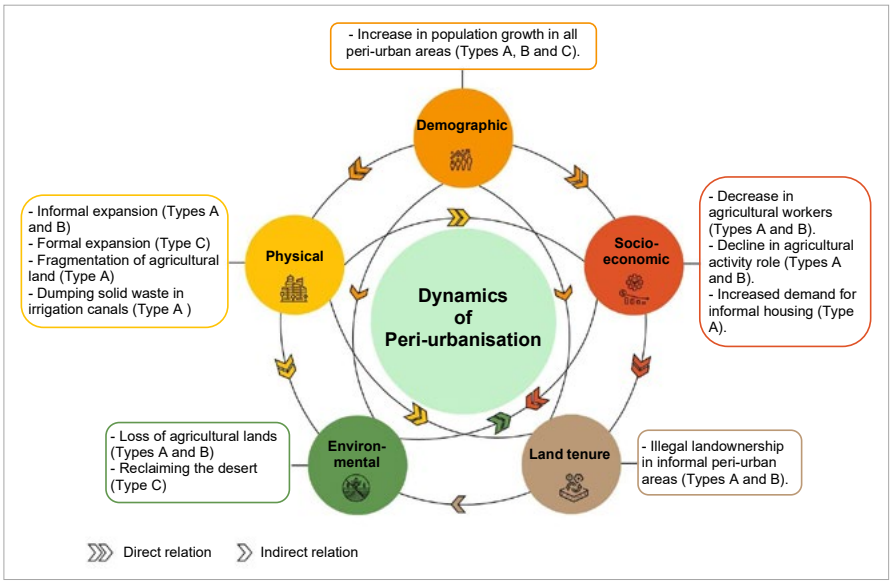

Figure 7: Conceptual model for Greater Cairo's peri-urban transformations
Source: Authors

air pollution, due to proximity to regional roads and industrial areas in two documents (El Araby, 2002; Mosilhi, 2017). Thus, implementing environmental legislation is crucial to conserving these areas. Land tenure became illegal in the informal peri-urban typologies in Giza and Qalyubiya (Type A) and on the Nile islands (Type B) in six publications (Table 2), as the price of these informal peripheral lands is low and the limited availability of affordable formal low-income housing (Kenawy, 2016; Sims *et al.*, 2003).

Several impacts have resulted from the peri-urban transformations in the Greater Cairo Region through analysing the effect of these changes depending on challenges and potentials themes in the reviewed documents, as shown in Table 3. The effects of demographic shifts in informal peri-urban areas in Giza and Qalyubiya (Type A) and on the Nile islands (Type B) were illustrated in 17 documents and in formal peri-urban areas on the reclaimed desert in one document (Table 3). Increased population in informal peri-urban types led to an increase in built-up areas that put pressure on infrastructure and basic services (Soliman, 2021; Tadamun, 2016), in addition to health problems and a lack of physician density that influence individuals' healthcare (Salem *et al.*, 2020d; Sims *et al.*, 2003). In contrast, the population growth in these areas is distinguished by strong social relations and a sense of community (Sims, 2012). Increase in population growth led to an increase in built-up areas in peri-urban areas on the reclaimed lands (Type C) (Mosilhi, 2017).

As shown in Table 3, one document illustrated that the decline in agricultural workers in peri-urban areas in Giza and Qalyubia (Type A) and on the Nile islands (Type B) affected agricultural productivity and financial returns (Youssef, 2019). Eight documents covered the impacts of the decline in the agriculture sector in peri-urban areas (Types A and B). They varied between loss of ecosystem and biodiversity, heat island effects, increased rate of unemployment, shortage in agricultural productivity, and increase

Table 2: An interpretive matrix of peri-urban transformations versus drivers in Greater Cairo derived from the reviewed documents.

		Physical factors				**Accessibility and proximity factors**			**Demo-graphic factors**			**Economic factors**			**Housing market**			**Legal and policy factors**		
	Driving forces / **Transformations**	Flat topography	Land-use and land-cover change	Subdivision of agricultural lands	Lack of solid waste system	Proximity to roads and transportation	Proximity to jobs and services	Proximity to industrial area	Rural-urban migration	Urban- rural migration	Overcrowding population in the main agglomeration	Seeking job opportunities	Different economic activities	Shifting to non-agricultural activities	Lack of low-income housing	Inability to rent a housing unit	High value of legal real estate	Development policy of the desert	Governmental incapacity to control encroachments	Total references per transformation
Demographic	Increase in the population of informal peri-urban (Types A and B)								4	1		2	1							8
	Increase in the population of formal peri-urban (Type C)		2															3		5
Socio-economic	Decrease in agricultural workers in informal peri-urban (Types A and B)			2					1					2						5
	Decline in agricultural activity role (Types A and B)		3	1										2					1	7
	Increased demand for informal housing (Type A)								1	1					2	1	2			7
Physical	Informal expansion in peri-urban (Types A and B)	4				7	4		4	1			1		2	2	2		6	33
	Scattered expansion on the reclaimed desert (Type C)					2					1							5		8
	Fragmentation of agricultural lands (Type A)			3															2	5
	Dumping solid waste in irrigation canals and drains (Type A)				3															3
Environmental	Loss of agricultural lands (Types A and B)		13	3										2					6	24
	Reclaiming the desert (Type C)																	3		3
	Air quality change (Types A, B and C)		2			2		1												5
Land tenure	Illegal landownership in informal peri-urban areas (Types A and B)														2	2	2			6
Total references per driving force		4	20	9	3	11	4	1	10	3	1	2	2	6	6	5	6	11	15	

Source: Authors

in food prices (Salem *et al.*, 2020a; Salem & Tsurusaki, 2024; Salheen & Attia, 2003). One publication showed that scattered urban growth in the peri-urban reclaimed deserts (Type C) can potentially offer new job opportunities (Sims, 2012). However, one publication demonstrated that air pollution from the nearby industrial areas and the reclaimed lands can lower agricultural productivity (El Araby, 2002). Moreover, four documents included that dumping solid waste in irrigation canals and drains in peri-urban areas in Giza and Qalyubiya (Type A) causes water pollution, loss of ecosystem and biodiversity, and health problems to residents (Denis & Séjourné, 2002; Mosilhi, 2017; Salheen & Attia, 2003; Tadamun, 2016).

Ten records covered the impacts of arable land loss in peri-urban areas in Giza and Qalyubiya (Type A) and on the Nile islands (Type B) in Table 3, including agricultural productivity decline, increase in unemployment rates, loss of ecosystem and biodiversity (El-Batran & Arandel, 1998; Salem & Tsurusaki, 2024; Youssef, 2019), in addition to heat island effects, owing to land-use and land-cover changes (Aboelnour & Engel, 2018). Three records in Table 3 discussed that traffic congestion on roads affected air quality in peri-urban areas in Giza and Qalyubiya (Type A) and on the Nile islands (Type B), and proximity to industrial area near obour city on the reclaimed desert (Type C) causes heat island effects and greenhouse gas emissions (El Araby, 2002; Youssef, 2019). These changes affect individuals' health (Mosilhi, 2017). Two documents in Table 3 pointed out that reclaiming desert in the peri-urban areas (Type C) provided an additional source for agricultural productivity and food security, and offered job opportunities (Salem *et al.*, 2020b; Sims, 2012). Illegal ownership causes an inability to obtain legal registration and building permits in peri-urban areas in Giza and Qalyubiya (Type A) (Nada, 2014; Sims, 2012; World Bank, 2008), in three documents in Table 3. In addition to issues related to land value in peri-urban areas on the Nile islands (Type B) (Howeidy *et al.*, 2009; Zayed, 2017), in two documents in Table 3.

Table 3: An interpretive matrix of peri-urban transformations versus impacts in Greater Cairo derived from the reviewed documents.

		Physical			**Economy**					**Environment**				**Health**		**Land issues**		**Society**	
Impacts / **Transformations**		Increase in built-up areas in informal peri-urban types	Increase in built-up areas in formal peri-urban type	Pressure in infrastructure and basic services	Decline in agricultural productivity and financial returns	Increased unemployment rate in informal peri-urban areas	Increase in land price	Source for agricultural productivity	Job opportunities	Loss of ecosystem and biodiversity	Heat island effect	Green gas house emissions	Water pollution	Health problems (diseases, drugs abuse and death rate)	Lack in healthcare (shortage of physician density)	Issues related to high land value on peri-urban Nile islands	Inability to legal registration and building permits	Social cohesion and sense of community	Total references per transformation
Demographic	Increase in the population of informal peri-urban (Types A and B)	2		8										2	2			3	17
	Increase in the population of formal peri-urban (Type C)		1																1
Socio-economic	Decrease in agricultural workers in informal peri-urban (Types A and B)				1														1
	Decline in agricultural activity role (Types A and B)				3	2				2	1								8
	Increased demand for informal housing (Type A)			2			1									2	3		8
Physical	Informal expansion in peri-urban (Types A and B)			4	5	2				2	1	1				2	3		20
	Scattered expansion on the reclaimed desert (Type C)								1			1							2
	Fragmentation of agricultural lands (Type A)				3					1	1								5
	Dumping solid waste in irrigation canals and drains (Type A)									1			2	1					4
Environ-mental	Loss of agricultural lands (Types A and B)				5	2				2	1								10
	Reclaiming the desert (Type C)							1	1										2
	Air quality change (Types A, B, and C)										1	1		1					3
Land tenure	Illegal landownership in informal peri-urban areas (Types A and B)															2	3		5
Total references per impact		2	1	14	17	6	1	1	2	8	5	3	2	4	2	6	9	3	

Source: Authors

The research had several limitations that should be acknowledged. Despite the efforts to search with different queries and terminologies related to the peri-urbanisation phenomenon in the Greater Cairo Region in the review process, this article is limited to available documents published in only three databases (Scopus, Web of Science, and Google Scholar). Another limitation is that forwards and backwards snowballing techniques in the review process may neglect some documents. An additional limitation is that the qualitative content analysis method may lead to some biases in interpreting the data. The authors attempted to minimise these biases, by using six stages of thematic synthesis, namely familiarising data, identifying keywords, generating codes, determining themes, reporting themes, and conceptualisation.

6. CONCLUSION

This study examined the dynamics of peri-urbanisation in the Greater Cairo Region with the aim of informing future research in urban and regional planning, particularly on strategies to enhance resilience. Using thematic synthesis and qualitative content analysis of 39 documents published between 1990 and 2025, the study addressed four objectives, namely identifying peri-urban typologies, exploring their drivers, challenges and prospects, and analysing the changes, causes, and effects of peri-urbanisation. The findings show that these dynamics can be understood across five key dimensions, namely typologies, drivers, challenges, prospects, and transformations.

Three peri-urban typologies were devised based on the review findings. Peri-urban areas in Giza and Qalyubiya (Type A) and peri-urban areas on the Nile islands (Type B) expanding informally on agricultural lands, as well as peri-urban areas on reclaimed desert lands (Type C), growing in formally recognised yet spatially dispersed patterns. The findings also show that the informal peri-urban types were examined more extensively in literature compared to the formal types.

The review on peri-urban expansion drivers demonstrated that population growth from rural-urban and urban-rural migrations seeking job opportunities, as well as the flat topography, susceptibility to encroachment, direct accessibility to roads and transport, unaffordability of low-income housing, and the government's inability to manage encroachments drive rapid urban expansion in the informal peri-urban typologies (Types A and B). The development policy that seeks to accommodate the accelerated population growth in the eastern and western deserts was the primary key driver of scattered peri-urban expansion on the reclaimed lands (Type C).

The literature review of peri-urban expansion challenges showcased that informal peri-urban typologies (Types A and B) were plagued by environmental degradation, high levels of poverty and unemployment, inadequate water and sanitation networks, poor solid waste management, impeding health challenges, and illegal landownership. Peri-urban areas on the reclaimed desert lands (Type C) suffered from environmental challenges related to changes in air quality.

Reviewing findings on peri-urban areas' prospects highlighted the promising potential of these areas in providing food production and ecosystem services to the main agglomeration, as well as the potential for offering diversified economic opportunities in peri-urban typologies: (Types A, B, and C), in addition to leveraging the community's social cohesion in peri-urban typologies (Types A and B).

Based on the review, Greater Cairo's peri-urban areas are undergoing significant rapid transformations that vary between demographic shifts, loss of agricultural lands, the emergence of reclaimed desert and air quality changes, decline in agricultural activities and the number of agricultural workers, increased demand for informal housing, and illegal land tenure.

In response to the above drivers, challenges, prospects, and transformations of peri-urban growth in Greater Cairo, further research is needed to assess the resilience capacities of these areas to assist researchers, urban planners, and policymakers in determining the appropriate trajectories for long-term resilience. Future research should tackle rapid urban expansion in these zones through effective land-management approaches. Moreover, future directions should address suitable environmental legislations and adaptive strategies such as water waste treatment practices, ecosystem and biodiversity protection approaches, energy efficiency improvements and heat island mitigation practices to promote sustainable development. Furthermore, expanding the study to include other databases and several bibliometric and network analyses using Vosviewer software to strengthen the understanding of peri-urbanisation phenomenon in Greater Cairo and identifying future key research priorities.

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