Demographic change and implication: empirical evidence from the peri-urban area of Denpasar City

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Abstract. The population has experienced almost exponential growth since the late 1800s. The socio-spatial organization, economic condition, and land-use patterns in peri-urban areas of developing countries have undergone significant changes as a result of these processes. This paper utilizes governmental data from 1990 to 2020 to examine the long-term demographic changes in the peri-urban areas of Denpasar City. The analysis is based on 17 specific areas within the city. The key discovery of our study is that the population of Denpasar's peri-urban regions has consistently grown, primarily driven by individuals in their working-age years. Consequently, demographic change has important implications for housing, utilities, and economic development, including living standards and livelihoods.

Keywords: Demographic Change; Population Growth; Productive Age; Peri-urban Area

1. Introduction

Peri-urbanization is the process of the significant aggregation of multifunctional communities. Population growth has been nearly exponential since the end of the nineteenth century [1], [2]. Population growth in the majority of developing nations is predominantly instigated by the movement of individuals from different regions to areas in close proximity to urban centers [3]. As rural regions skirting cities become progressively more urbanized, this growth pattern has posed a challenge for regional progress [4].

Population growth as a result of peri-urbanization is mainly due to the availability of land in city areas [3]. It will be impossible for the land to expand to accommodate the growing population's demand for additional workspace to earn a living, as it remains steady and does not expand. Therefore, citizens will look for new land in other areas nearby the city, and the destination is the peri-urban area. Peri-urban regions have experienced substantial population growth due to the influx of migrants from both within and outside the city who are encouraged to settle in these areas [5]. Yunus (2008) explains that peri-urban areas are eager to attract new residents. Some of the most influential pull factors are the presence of special activity centers such as industrial, housing, and even university (Yunus, 2008; Sikarwar et al., 2020) as well as a more friendly living environment [6].

The rise of migrant populations in peri-urban regions indirectly impacts the area's demographic makeup. Demographic changes, also known as population dynamics, are

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variations in population characteristics, which include population size, population composition based on age and sex, and population density [7]. Recent studies have found that demographic changes are characterized by declining birth rates, rising life expectancy, aging, population shrinkage, heterogenization, and population individualization [8]. These trends are accompanied by a significant decline in the average household members and a rise in the number of households [8], [9]. The aforementioned processes have a profound impact on the socio-spatial organization, economic state, and land-use patterns of peri-urban regions. In particular, infrastructure development and residential areas are compelled to adjust in response to the demographic shift. The purpose of this research was to characterize dynamic demographic changes that have occurred over multiple decades in the peri-urban regions of Denpasar City.

2. Method

The present study is carried out in the peri-urban regions of Denpasar City. As mentioned earlier, the peri-urban regions under investigation in this research are classified into two distinct categories: inner peri-urban regions and outer peri-urban regions. The subdistricts located within or on the inner periphery of the administrative boundary of Denpasar City are referred to as the inner peri-urban areas. On the contrary, the outer peri-urban regions comprise villages situated in close proximity to or on the periphery of the administrative boundary of Denpasar City. Both have spatial expressions that show a combination of rural and urban characteristics. Demographic change is a phenomenon of population dynamics in either increasing or decreasing the number of people in peri-urban areas from time to time. This objective required several datasets about the social features of Denpasar City's peri-urban areas from its inception was necessary to analyze the demographic changes. Time-series data about social features were necessary to correlate land-use change. The demographic data is related to population size, composition, and population density. The expected output of the research objective is demographic changes charts and population pyramids dynamics in the study area. This research is used a qualitative approach [10]. Qualitative data are gathered through secondary sources. Secondary data are critical for this research, as they are required to analyze peri-urban demographic changes. The government agencies, provincial statistics office, policy papers, books, reports, and journal articles are used to collect data. At the regional level, data are gathered from relevant regional organization agencies, particularly those that fall under the jurisdiction of the district office. The examination of these documents revealed patterns of demographic changes in peri-urban areas. Thematic analysis is employed for the examination of qualitative data.

3. Results and Discussions

3.1 Persistent population growth in the peri-urban areas

A summary of the population size findings for each peri-urban area is presented in Figure 1. Significant differences exist between the inner and outer peri-urban populations. The inner peri-urban areas have a larger population.

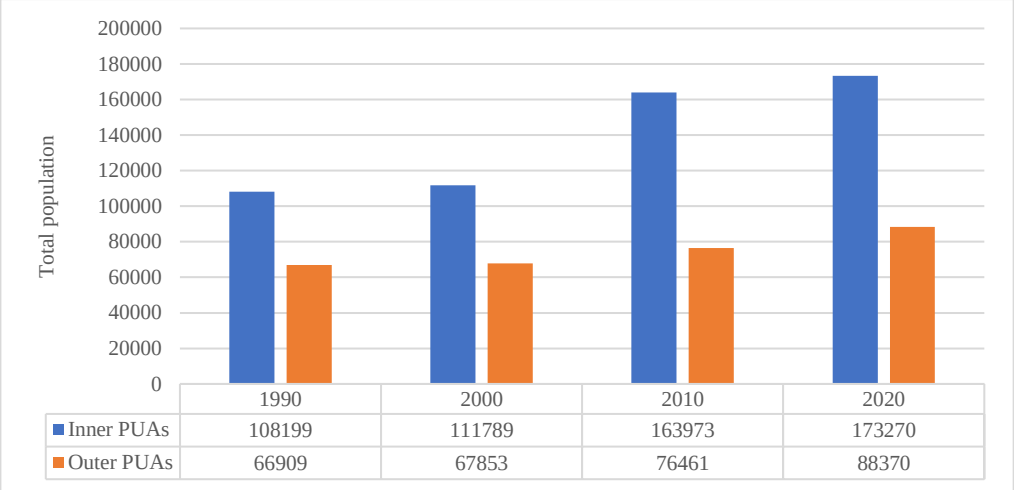


Figure 1. Denpasar city's peri-urban areas population size trends

The population growth over the past three decades of data analysis is presented in Figure 2. The population growth rate in the inner peri-urban areas was minimal in the first decade (1990–2000), at 3.32%, but rocketed in the second decade (2000–2010), reaching 46.8%, before slowing to 5.67% in the last decade (2010–2020). Meanwhile, the population growth rate in the outer peri-urban areas consistently increased by 1.41% in the first decade (1990–2000), increased to 12.69% during the second decade (2000–2010) and accelerated to 15.58% in the last decades (2010–2020). In conclusion, the number of people living in the peri-urban area of Denpasar City has steadily grown over the past decades. Population growth in inner peri-urban areas peaked between 2000 and 2010. On the contrary, population expansion persisted in the outer peri-urban regions throughout the subsequent decades. It is intriguing to note that over the past few decades, population growth in the outer peri-urban regions has been more substantial than in the inner peri-urban regions.

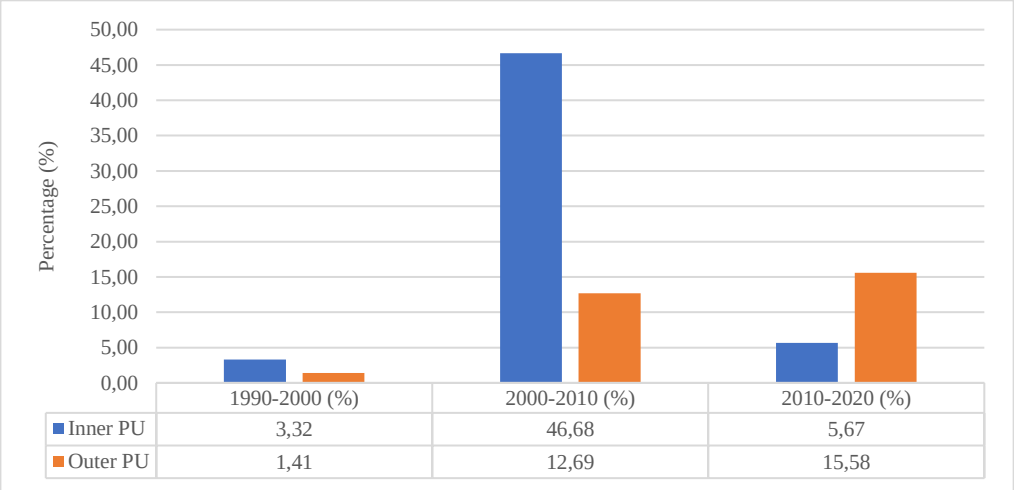


Figure 2. The growth of population size in Denpasar city's peri-urban areas

Peripheral regions will inevitably experience population growth. The findings revealed a consistent upward trend in population within the peri-urban regions of Denpasar. The evidence indicates that the population of inner peri-urban areas is greater than that of outer peri-urban areas, but that the latter have a more stable population growth trend. Similar to prior research, this discovery indicates a substantial surge in the population residing in peri-urban regions [2], [8], [11]. Moreover, numerous studies even have discovered that the population growth rate in peri-urban areas is higher than in urban areas [3], [12]. This fact implies that the peri-urban area will become the next population growth epicenter.

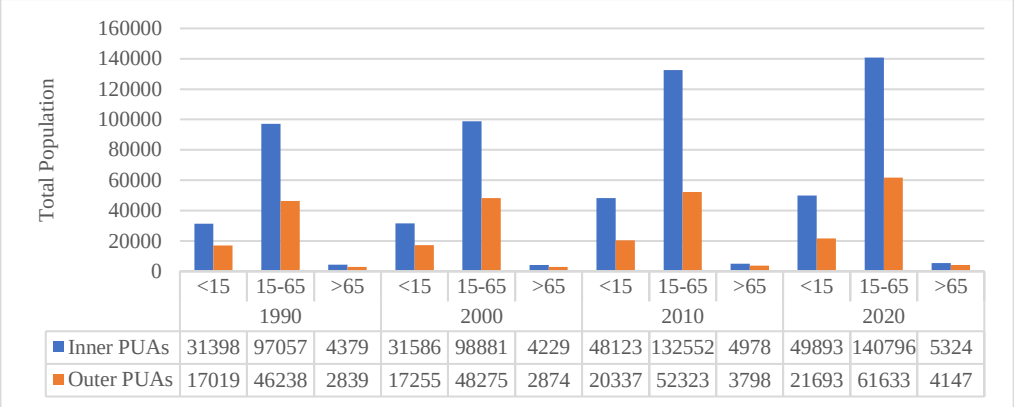
The population growth trend in peri-urban areas is shaped by increasing living standards [13], [14]. The increases in longevity and life expectancy are associated with population aging. The decline in mortality rates has played a role in a pattern whereby both the elderly population and their percentage of the overall populace are on the rise [15], [16]. These trends are also followed by a rapid rise in in-migration (Slack & Jensen, 2020), both of productive age and pensioners, who target peri-urban areas as places to live and work. These factors significantly contributed to peri-urban population growth.

The persistent increase in population will further erode the boundaries between urban and rural environments. The findings indicate that the rate of population growth in outer peri-urban areas is significantly more consistent. This suggests that the region will experience increased ethnic and racial diversity and integration. The gradual but consistent pattern will expedite the transformation of outer peri-urban regions into urban environments at a faster rate compared to inner peri-urban areas. As peri-urban areas undergo urbanization, nearby rural areas adjacent to the outer peri-urban areas will initiate a new process of peri-urbanization.

Demographic change in terms of population size has essential implications for housing. The availability of affordable housing is a significant and classic issue for a large number of people, primarily migrants [17], [18]. Moreover, utilities providing local public services, including transportation, electricity, oil and gas, water supplies, and sewage disposal, are especially prone to population growth [15], [19]. Furthermore, the population growth rate will also have implications for economic development [20], including the standard of living and livelihoods.

3.2 The rise of productive age in the peri-urban areas

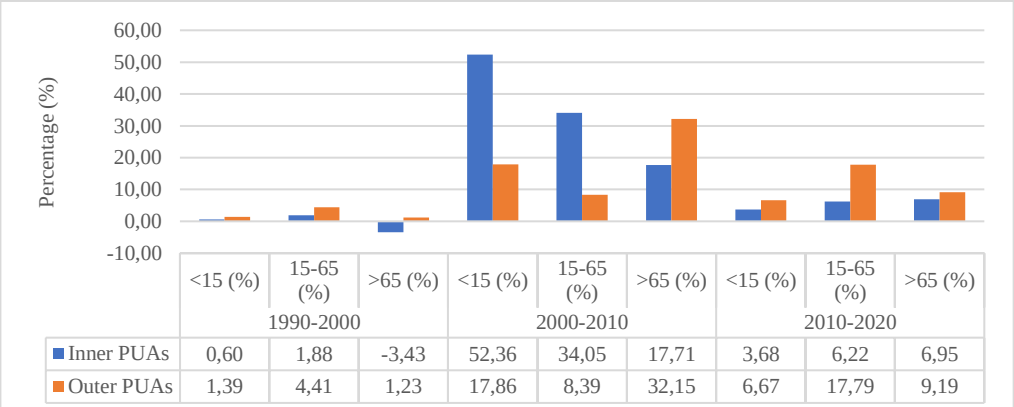
The composition of the population is not only a reflection of past demographic processes but also a description of future population trends. The population composition primarily used for analysis and development planning is based on age and sex. Figure 3 provides a summary of the population composition by age for each peri-urban area. The age-based population composition dynamics in both inner and outer peri-urban areas exhibit significant similarities. Both regions are characterized by a prevalence of older age groups. Nevertheless, the inner peri-urban areas exhibit a higher concentration of adult residents compared to the outer peri-urban areas.



	1990			2000			2010			2020		
	<15	15-65	>65	<15	15-65	>65	<15	15-65	>65	<15	15-65	>65
Inner PUAs	31398	97057	4379	31586	98881	4229	48123	132552	4978	49893	140796	5324
Outer PUAs	17019	46238	2839	17255	48275	2874	20337	52323	3798	21693	61633	4147

Figure 3. Denpasar city's peri-urban areas age-based population trends

The age-based population growth over the past three decades of data analysis is presented in Figure 4. In the inner peri-urban areas, the growth rate of the mature-age population was minimal in the first decade (1990–2000) at 1.88% but rapidly expanded in the second decade (2000–2010) with 34.05% before slowing in the last decade (2010–2020). Younger people followed similar patterns as the mature-age population. In the second decade, younger people's growth exceeds that of mature-age and the elderly. However, the elderly experienced a shrinking rate in the first decades of -3,43%, rising in the second decade to 17,71%, and slowing down in the last decades to 6,95% (considerably more prominent than the mature-age and younger population). In the outer peri-urban areas, the mature-age population growth pace consistently increased by 4,41% in the first decade (1990–2000), scaled up to 8,39% in the second decade (2000–2010), and expanded to 17,79% in the last decade (2010–2020). The growth of the younger population relatively fluctuates from 1,39% in the first decades, increased to 17,86% in the second decade, and slowed down in the last decades to 6,67%. Equally to younger people, the elderly also exhibited similar trends. Indeed, the rate of increase in the elderly population is greater during the second decade compared to both the mature-age and younger populations.



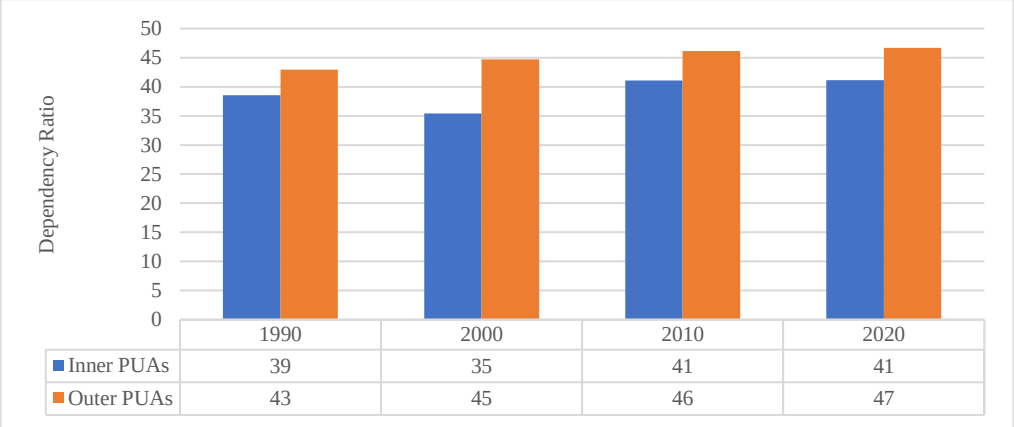
	1990-2000			2000-2010			2010-2020		
	<15 (%)	15-65 (%)	>65 (%)	<15 (%)	15-65 (%)	>65 (%)	<15 (%)	15-65 (%)	>65 (%)
Inner PUAs	0,60	1,88	-3,43	52,36	34,05	17,71	3,68	6,22	6,95
Outer PUAs	1,39	4,41	1,23	17,86	8,39	32,15	6,67	17,79	9,19

Figure 4. Age-based population growth in Denpasar city's peri-urban areas

In summary, the demographic makeup, specifically the proportion of older individuals in peri-urban regions, has been consistently growing over several decades. The population of older individuals in the inner peri-urban areas reached its highest point between 2000 and 2010, while the number in the outer peri-urban areas continued to rise in the subsequent decades. Typically, the population of both younger and older individuals tends to increase at a faster rate in the outer peri-urban areas compared to the inner peri-urban areas.

Age-based population composition also indicates regional productivity. Productivity divides the population into productive and non-productive age groups. The productive age population is 15–65, while the non-productive age population is divided into two groups: not-productive (under 15) and unproductive (over 65). The dependency ratio can be calculated by comparing productive and non-productive age groups. Mantra (2000) defines dependency ratio as the burden productive age bears over non-productive age. Figure 5 shows level dependency ratio data. Dependency ratio dynamics differ in inner and outer peri-urban areas.

Based on the calculations, the dependency ratio in the outer peri-urban areas is higher than in the inner peri-urban areas. The dependency ratio in the outer peri-urban areas has been in the high category since the early decades, when it reached 43, and has steadily risen to 47. This value means that every 100 people of productive age are responsible for 47 people of non-productive age. Meanwhile, the dependency ratio in the inner peri-urban areas is moderate and tends to decrease from 1990 to 2000 (39 to 35), increasing with a constant value between 2010 and 2020 (41) and remaining relatively high. Interestingly, the unproductive population is the largest contributor to the high dependency ratio in the outer peri-urban areas. In contrast, the dependency ratio in the inner peri-urban areas is affected by the high number of not-productive populations.



	1990	2000	2010	2020
Inner PUAs	39	35	41	41
Outer PUAs	43	45	46	47

Figure 5. Dependency ratio level in Denpasar city's peri-urban areas

Furthermore, the population pyramid can be used to describe the comprehensive population composition. The population pyramid visualizes the population structure that characterizes age and gender at five-year intervals. The population pyramid can also illustrate the transition of the population's structure into three pyramidal forms: expansive, constructive, and stationery.

The findings of the analysis reveal that the shape of the population pyramid in peri-urban areas is a pyramid that is transitioning into a constructive pyramid. This pyramid has a youth population of less than 40% and an elderly population of less than 10%. This fact indicates that

this pyramid does not characterize the structure of the young and old populations. This pyramid also illustrates the transitional phase toward a mature-age population with stagnant birth rates and declining death rates. Comparison of the percentage of young people with mature-age, which is a manageable size, causes the population pyramid of peri-urban areas to be classified into an imperfect constructive pyramid.

The visualization of population structure changes in Denpasar city's peri-urban areas are shown in Figure 6 (in the inner peri-urban areas) and Figure 7 (in the outer peri-urban areas). The results of the analysis indicate that the population pyramids of inner and outer peri-urban areas are quite similar. To discuss the process of changing this population structure in detail, the population pyramid can be divided into three categories: younger (0-14 years), mature-age (15-65 years), and older people (65+ years).

In the inner peri-urban areas, the structure of the younger age group has changed significantly. There has been an upward trend in births from 2000 to 2010, where the length of the pyramid's wings for younger age groups (0–4 years) increased. In the mature-age category, there is an anomaly and an interesting fact: the age category 25–34 has longer pyramid wings than other age groups. This wing's length indicates that the inner peri-urban areas experienced a significant increase in population, which is strongly suspected to be the consequence of incoming migrants. Additionally, there has been a shift in the demographic composition of the elderly population residing in the inner peri-urban regions. The primary catalyst for these structural modifications is the substantial increase in the population of individuals between the ages of 65 and 69 over the last three decades. The aging population of this area is primarily driven by factors such as a higher life expectancy, better health insurance, increased concern for the health of the elderly, and the influx of retired individuals who wish to reside and establish themselves in inner areas.

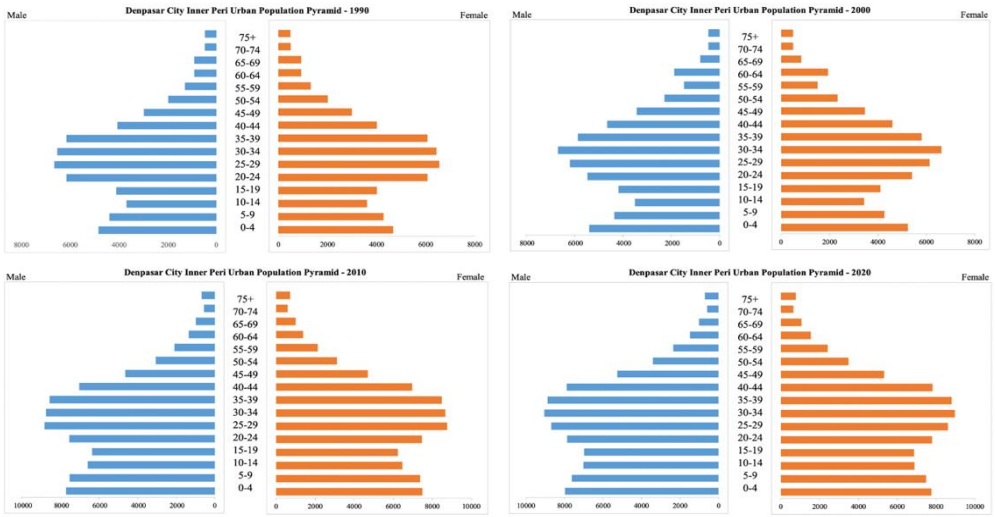


Figure 6. Population Pyramid Trends in Denpasar city's inner peri-urban areas

In the outer areas, younger population changes are relatively stable. From 2000 to 2020, there is a tendency for births to decrease. This rate can be seen in the shortening of the pyramid's wings aged 0–4 years. In the mature age, an interesting phenomenon exists: the 30-39 age group has longer wings than other age groups. The length of this wing suggests a notable rise in population in the outer peri-urban regions, which is highly likely to be caused by an influx of

people moving in. Furthermore, there have been alterations in the demographic composition of the elderly population residing in the outer peri-urban regions. These structural changes are more related to the increase in the 65–69 age group in the last three decades. High life expectancy, promoting health facilities, active empowerment, and the in-migration of retired people desiring to live in more comfortable areas all contribute to the aging population of this area.

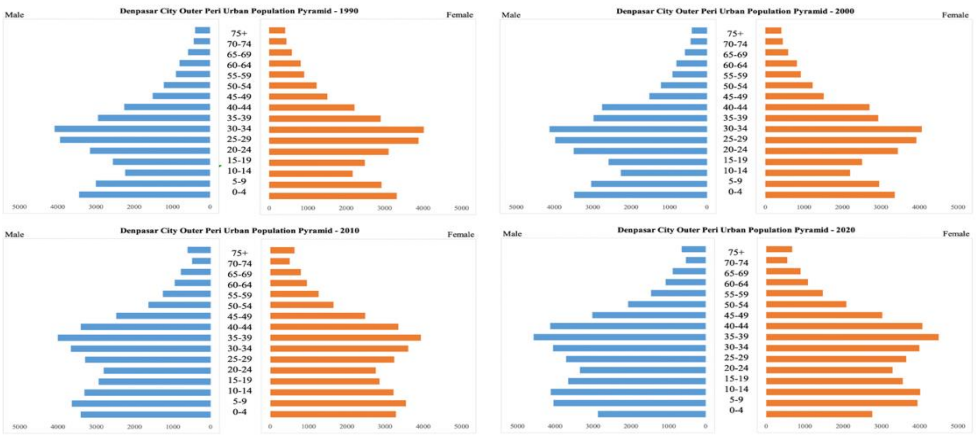
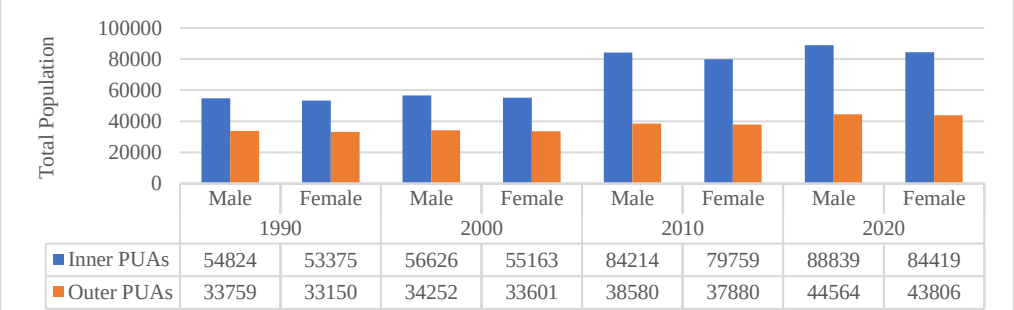


Figure 7. Population Pyramid Trends in Denpasar city's outer peri-urban areas

The results of population composition based on sex for each peri-urban area are summarized in Figure 8. The dynamics of the population composition based on sex in inner and outer peri-urban areas are quite similar. Both are dominated by males. However, the inner peri-urban areas have a larger male population than the outer peri-urban areas.



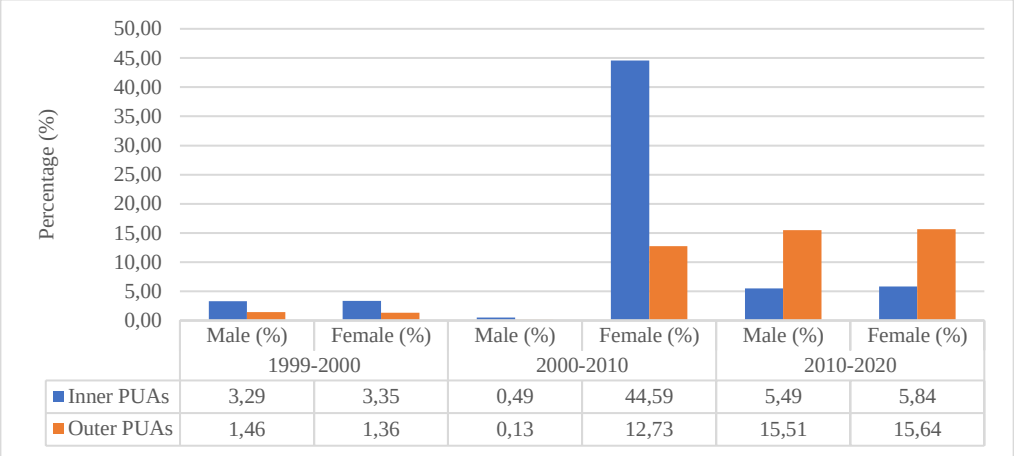
	Male 1990	Female 1990	Male 2000	Female 2000	Male 2010	Female 2010	Male 2020	Female 2020
Inner PUAs	54824	53375	56626	55163	84214	79759	88839	84419
Outer PUAs	33759	33150	34252	33601	38580	37880	44564	43806

Figure 8. Denpasar city's peri-urban areas sex-based population trends

The sex-based population growth over the past three decades of data analysis is presented in Figure 9. The growth of the population based on sex has a different story. The female growth rate outmatched the male. In the inner peri-urban areas, female growth rate already dominated in the first decades (1990–2000) with 3,35%, and it rocketed in the second decade (2000–2010) with 44,59% and slowing down in the last decade (2010–2020) with 5,84%. Male growth rates

showed different growth rate trends. The male growth rate relatively fluctuates, at minimum in the first decades within 3,29%, declining in the second decades at 0,49% and rising in the last decades at 5,49%. In the outer peri-urban areas, the female growth rate consistently increased by 1,36% in the first decades (1990–2000), scaled up to 12,73% in the second decade (2000–2010), and expanded to 15,64% in the last decade (2010–2020). The male growth in the outer peri-urban areas also fluctuates, from 1,46% in the first decade, decreasing to 0,13% in the second decade, and rising to 15,51% in the last decades.

Finally, peri-urban female population composition has steadily increased over the decades. Inner peri-urban female growth peaked between 2000 and 2010, while outer peri-urban growth continued in the following decades. The inner and outer peri-urban male population fluctuated but rose in recent decades.



	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)
	1999-2000		2000-2010		2010-2020	
Inner PUAs	3,29	3,35	0,49	44,59	5,49	5,84
Outer PUAs	1,46	1,36	0,13	12,73	15,51	15,64

Figure 9. Sex-based population growth in Denpasar city's peri-urban areas

Moreover, the population composition based on sex also reflects the sex ratio of the population in an area. The sex ratio is the proportion of males to females in a population. Data analysis on the level sex ratio is presented in Figure 10. Distinction exists between the inner and outer peri-urban regions regarding the dynamics of the sex ratio. The calculation indicates that the sex ratio is greater in the inner peri-urban regions than in the outer peri-urban regions. On the contrary, the sex ratio in inner peri-urban regions exhibits a volatile trend, commencing at 103 between 1990 and 2000, surging to 106 in 2010, and subsequently declining to 105 in 2020. Conversely, the sex ratio in the periphery's outermost regions has remained constant at 102. The inner peri-urban regions exhibit the highest sex ratio value of 106. This value signifies that the ratio of males to females will be 106 to 100. Despite the relatively larger male population, the male-to-female ratio in peri-urban areas is relatively equitable.

Figure 10. Sex ratio level in Denpasar city's peri-urban areas

People of working age were preponderant in peri-urban regions, specifically in the inner peri-urban zones. Consistent with prior research conducted in villages situated in proximity to major metropolitan areas, this discovery demonstrates a substantial surge in the population of individuals of working age [1], [21], [22]. This condition is conversely related to population growth in urban areas, where the population structure is beginning to experience aging [9], [11], [23].

The high number of working-age migrants entering peri-urban areas indicates that this area has a distinct and powerful magnet. Recent studies have identified three major factors that attract migrants to peri-urban areas, including land prices, economic activity, and environmental conditions [21], [24]. Relatively low land prices, including affordable house rental prices, are the primary determinant for migrants, especially urban migrants, to settle in peri-urban areas close to workplaces in cities. Various economic activities have flourished in peri-urban areas due to the expansion of settlements. The development of economic activity is what attracts migrants, especially rural migrants, to start businesses that are generally dominated by the informal sector. Lastly, green and friendly-neighborhood environmental conditions have motivated migrants, especially migrants with nucleus families (pioneers), to find a secure and comfortable place to raise their children. These three factors positively influence the productive-age population growth in peri-urban areas.

The population structure, dominated by people of productive age, positively affects regional economic growth [17], [20], [25], [26]. The relatively low proportion of the young and old population will reduce the investment to meet their needs so that resources can be diverted to spur economic growth. Opportunities for economic benefits obtained by a region or country as a result of a large proportion of the productive population are known as "demographic bonuses" [27]. The demographic bonus occurs when the number of people in the productive-age population is higher than those in the non-productive population or when the dependency ratio is less than 50 [27], [28]. The results indicate that the average dependency ratio in peri-urban areas is less than 50. Nonetheless, the dependency ratio tends to increase over time, particularly in outer peri-urban areas. If this trend continues and the dependency ratio keeps rising, the demographic bonus in peri-urban areas will be jeopardized.

4. Conclusion

Population is a crucial factor in the development of peri-urban areas. The population dynamics in peri-urban areas, characterized by a significant increase in size, are primarily driven

by a balanced male and female ratio within the productive age group. This relatively dense population can effectively support the economic growth and development in the peri-urban areas of Denpasar city. The correlation between human capital and economic profit is directly proportional to the size of the population within the productive age range. Consequently, regulations and management relating to access and equal job opportunities for locals, non-locals, and males and females must be of the utmost importance. In addition, initiatives to improve the education of young people and public services for the elderly are required to alleviate their dependence on the population of productive age.

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