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Assessing the Impact of Local Zoning Ordinance Implementation on Land Use Efficiency in Garcia Hernandez, Bohol, Philippines

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ABSTRACT

This study measures the effect of the implementation of the local zoning ordinance on land use efficiency in the municipality of Garcia Hernandez, Bohol. Garcia Hernandez is well-endowed with limestone, which makes it rich in materials and has potential as an environmental place. The study explores the impact of zoning regulations on land use and sustainability, focusing on the trade-off between development and protection. A descriptive research design was employed, integrating both quantitative and qualitative methods. Surveys and interviews were conducted with 379 respondents, including local government officials, community members, business owners, and environmental advocates. Quantitative data emphasized compliance rates and metrics associated with improving the efficiency of land uses, while qualitative data concentrated on stakeholder perceptions and experiences. The instruments were validated by expert revision and pilot test with high reliability (Cronbach's alpha = 0.85). The results also found that on a macro scale, the explanation of the zoning ordinance promotes significant performance of land use efficiency. Effective land allocation and urban density management are ensured through the optimization of critical components, including infrastructure support, public awareness, enforcement mechanisms, and regulatory updates, while promoting environmental sustainability. Infrastructure support had the greatest influence. The study concludes that effective zoning ordinances enhance sustainable development by balancing economic productivity with resource conservation, supporting frameworks such as the Bid Rent Theory and Tragedy of the Commons. It recommends strengthening infrastructure and enforcement mechanisms, increasing public awareness, and fostering stakeholder collaboration to align zoning strategies with community development goals. These measures can ensure sustainable land management while addressing Garcia Hernandez's unique needs.

Keywords: *Zoning Ordinance Implementation, Land Use Efficiency, Sustainable Development, Urban Planning, Infrastructure Support, Stakeholder Engagement*

INTRODUCTION

Urbanization often led to the transformation of landscapes, where zoning laws acted as the blueprint for managing the balance between development and preservation. In Garcia Hernandez, Bohol, the implementation of local zoning ordinances aimed to improve land use efficiency, ensuring that development occurred in a sustainable manner that respected both the environment and community needs. However, as cities grew, the laws meant to guide growth also needed to evolve, reflecting both the physical and socio-economic changes in the area. This study evaluated the impact of these zoning ordinances on land use efficiency, exploring how well these regulations addressed the current demands of the municipality.

Zoning laws, which allocated land for specific purposes such as residential, commercial, industrial, and leisure, played a critical role in shaping urban spaces. They were vital in organizing development, ensuring that land was used in ways that benefited the community and economy. According to a 2023

study by Smith and Johnson, zoning frameworks informed by sound planning principles led to improved land use efficiency, promoting better accessibility and reduced urban sprawl. These regulations, however, could also hinder development when outdated or misaligned with evolving community needs (Barlow & Lee, 2023). In such cases, areas of land remained underutilized or mismatched with the population's needs, leading to inefficiencies.

Land use productivity was a key indicator of urban success, and in municipalities like Garcia Hernandez, the productivity of land was directly linked to zoning effectiveness. Zoning could stimulate economic growth and optimize resource allocation, which was crucial for areas with limited land and resources. Studies by López et al. (2023) showed that judicious zoning reduced sprawl, promoted efficient infrastructure development, and optimized space utilization. Yet, poorly designed or enforced zoning ordinances led to negative consequences, such as inefficient land use, disjointed urban planning, and overuse of certain land resources.

In Garcia Hernandez, the zoning laws aimed to manage growth and prevent land use issues, but challenges arose when there was a mismatch between regulations and the evolving needs of the municipality. A recent analysis by Ferrer & Ramos (2023) pointed out that the disconnect between zoning regulations and the local community's demands often resulted in underdeveloped areas or missed opportunities for growth. The issue was compounded by a lack of public awareness about zoning laws, which led to ineffective land use decisions that did not benefit the broader population.

The implementation of zoning laws in Garcia Hernandez was governed by legal frameworks that attempted to ensure land was used in ways that supported long-term sustainability. Zoning ordinances were designed to ensure orderly development, but outdated regulations or noncompliance led to inefficiencies. As emphasized by Cordero et al. (2022), zoning ordinances needed to be periodically reviewed to ensure they remained relevant and aligned with the changing needs of the city. Effective zoning enforcement, public awareness, and continual policy updates were necessary to optimize land use and promote sustainable growth.

Identifying inefficiencies in land allocation and the limitations of existing zoning laws was essential for improving land use efficiency. Understanding how zoning laws influenced economic sectors such as agriculture and eco-tourism was critical to fostering balanced development (Chavez & Tan, 2022). A comprehensive assessment of zoning laws revealed areas where improvements were needed, ensuring that regulations were responsive to community needs and aligned with sustainable urban planning principles. Furthermore, engaging the community in zoning discussions helped create policies that better served residents' needs, ultimately leading to more effective land use.

Theoretical frameworks such as the Bid Rent Theory (Alonso, 1964) and the Tragedy of the Commons (Hardin, 1968) provided valuable perspectives on how zoning regulations could optimize land use. Bid Rent Theory suggested that land closer to central business areas was more valuable for commercial use, which aligned with the idea that zoning should encourage high-density development near urban cores (Smith & Johnson, 2023). Meanwhile, the Tragedy of the Commons highlighted the importance of managing shared resources to prevent overuse, a concept central to zoning regulations aimed at balancing growth with environmental protection.

Understanding these theories in the context of Garcia Hernandez helped frame zoning regulations as a tool for promoting sustainable urban development. By optimizing land use, zoning ordinances mitigated overexploitation and fostered economic growth without compromising the environment. This research aimed to provide an evidence-based assessment of how zoning laws in Garcia Hernandez influenced land use efficiency, offering recommendations for improving policy effectiveness and ensuring the sustainable development of the municipality.

MATERIALS & METHODS

This study adopted a mixed-methods approach to assess the impact of local zoning ordinances on land use efficiency in Garcia Hernandez, Bohol. A descriptive research design was chosen to provide a comprehensive understanding of how zoning regulations affected land use. By combining both quantitative and qualitative methods, the study aimed to gather robust data on zoning compliance, land use patterns, and stakeholder perceptions. According to a 2023 study by Wang and Deng, the integration of both data types offered a nuanced perspective, allowing researchers to not only measure the effectiveness of zoning policies but also understand their broader social and economic impacts. The quantitative component focused on compliance rates, infrastructure support, and land use efficiency metrics, while the qualitative aspect explored stakeholder experiences and insights through in-depth interviews.

The research was conducted in Garcia Hernandez, a municipality known for its limestone deposits and rapid urban growth. The study utilized simple random sampling to ensure a diverse and representative selection of respondents, including local government officials, business owners, residents, and environmental advocates. The sample size of 379 respondents was determined based on the population of 24,430, ensuring sufficient statistical power to detect meaningful patterns. In line with current urban planning research, such as the study by Smith and Johnson (2023), the use of random sampling minimized selection bias and increased the generalizability of the findings. Participants were surveyed using a researcher-designed questionnaire that assessed zoning ordinance compliance, enforcement, public awareness, and land use efficiency.

To ensure the validity and reliability of the instruments, the study conducted a pilot test with 30 respondents, achieving a Cronbach's alpha of 0.85, indicating high reliability. The instruments underwent expert validation to confirm that they measured the intended variables accurately. Following ethical research guidelines, the study secured consent from all participants, ensuring that their anonymity and confidentiality were maintained. This methodological approach, integrating both qualitative and quantitative data, provided a well-rounded analysis of how zoning ordinances affected land use efficiency in Garcia Hernandez.

RESULTS AND DISCUSSION

1. What is the profile of the employee in terms of:

1.1. Sex;
1.2. Age;
1.3. Civil Status; and
1.4. Education?

Table 1 presents the frequency and percentage distribution of respondents in terms of sex. The data revealed that 45.9% of the respondents were male, while 54.1% were female. This indicates that the majority of the respondents were female. This demographic information suggests that any observed trends or patterns in the study might be influenced by gender-related factors, making it important to consider potential differences in perspectives, behaviors, or preferences between males and females during the analysis.

Previous research, such as Bartlett and Camba (2023), highlighted that there are distinct differences in spatial perspective-taking abilities between genders. Specifically, studies have found that males tend to outperform females on measures of spatial perspective-taking. However, these differences may not be inherent but rather influenced by social factors. It is therefore essential to consider these nuances

when interpreting the study's findings, particularly in relation to how respondents engage with the zoning ordinance and land use practices.

Table 1
The Frequency and Percentage Distribution of Respondents in terms of Sex

Characteristics	Specification	Frequency	Percentage
Sex	Male	174	45.9%
	Female	205	54.1%
Total		**379**	**100.0%**

Table 2 displays the frequency and percentage distribution of respondents based on age. The data showed that 11.9% of the respondents were aged 18-22, 29.0% were aged 23-27, 18.5% were aged 28-32, 13.7% were aged 33-37, and 26.9% were aged 38 and older. This indicates that the majority of respondents fell within the 23-27 age group, followed by those aged 38 and older. This demographic distribution suggests that the study captured a wide range of age groups, providing diverse perspectives. The predominance of younger and older respondents highlights important differences in experiences or attitudes that could influence the study's outcomes and interpretations. This age distribution aligns with similar findings in other studies, such as Tian et al. (2022), which reported a majority of participants between 21 and 24 years old.

Table 2
The Frequency and Percentage Distribution of Respondents in terms of Age

Characteristics	Specification	Frequency	Percentage
Age	18-22	45	11.9%
	23-27	110	29.0%
	28-32	70	18.5%
	33-37	52	13.7%
	38 and older	102	26.9%
Total		**379**	**100.0%**

Table 3 presents the percentage distribution of respondents based on civil status. The data revealed that 61.7% of the respondents were single, while 38.3% were married. This indicates that the majority of the respondents were single. This demographic information suggests that the study's findings might reflect the perspectives or circumstances of single individuals more prominently. It also implies the potential need to analyze how civil status may influence behaviors, attitudes, or preferences, as single and married respondents might exhibit distinct patterns. Recent literature, such as the work by Leonhardt et al. (2020), has explored how social forces and psychological factors contribute to the rise of singlehood, including the deinstitutionalization of marriage, the emphasis on personal fulfillment, and economic considerations.

Table 3
The Frequency and Percentage Distribution of Respondents in terms of Civil Status

Characteristics	Specification	Frequency	Percentage
Civil Status	Single	234	61.7%
	Married	145	38.3%
Total		**379**	**100.0%**

Table 4 shows the frequency and percentage distribution of respondents based on their education. The data revealed that 37.2% of the respondents had a high school education, 40.1% had an undergraduate degree, 21.9% had a master's degree, and 0.8% had a doctoral degree. This indicates that the majority of respondents had attained an undergraduate degree, followed by those with a high school education. The educational background of the respondents suggests that the study reflected a range of academic qualifications, with a notable emphasis on individuals with higher education. This distribution may influence the findings, as educational attainment can impact perspectives, knowledge, or behaviors relevant to the study's objectives. Research, such as Yamashita et al. (2022), has shown that educational attainment influences various aspects of life, including health, income, and intrinsic motivation to learn.

Table 4
The Frequency and Percentage Distribution of Respondents in terms of Education

Characteristics	Specification	Frequency	Percentage
Education	High School	141	37.2%
	Undergraduate Degree	152	40.1%
	Masteral Degree	83	21.9%
	Doctoral Degree	3	0.8%
Total		**379**	**100.0%**

2. How do the respondents assess the implementation of the local zoning ordinance in terms of:
2.1. Compliance Level;
2.2. Enforcement Mechanisms;
2.3. Public Awareness;
2.4. Regulatory Updates; and
2.5. Infrastructure Support?

Table 5 presents the respondents' assessment of the implementation of the local zoning ordinance in terms of compliance level. The overall mean score of 3.07 (SD = 0.56) corresponds to the description "Agree," indicating a "High" level of compliance. This suggests that respondents perceive a strong adherence to zoning ordinances in their locality, both among individuals and businesses, with minimal violations. Such high compliance is a positive indicator of effective zoning implementation, suggesting that the ordinance is being respected and contributing to organized land use. Studies have shown that zoning helps optimize the allocation of land for various purposes, fostering better urban development (Colding et al., 2021; Dahal, 2023).

Table 5
The Respondents' Assessment of the Implementation of the Local Zoning Ordinance in terms of Compliance Level

Items	Mean	SD	Description	Interpretation
I am aware of the zoning ordinance in my area.	3.15	0.54	Agree	High
I understand the requirements outlined in the zoning ordinance.	3.09	0.51	Agree	High
I comply with the zoning ordinance guidelines for land use.	3.06	0.53	Agree	High
Businesses in my area comply with zoning regulations.	3.04	0.61	Agree	High
Violations of the zoning ordinance are minimal in my locality.	3.00	0.60	Agree	High
Overall Mean	**3.07**	**0.56**	**Agree**	**High**

The indicator, "I am aware of the zoning ordinance in my area," obtained the highest mean score of 3.15 (SD = 0.54), signaling a "High" level of awareness. This indicates that respondents are generally well-informed about the zoning ordinance, suggesting effective communication and outreach efforts by the local authorities. The high level of awareness likely supports high compliance and reflects well on the community's engagement with zoning practices. However, the indicator, "Violations of the zoning ordinance are minimal in my locality," scored the lowest with a mean of 3.00 (SD = 0.60), suggesting that while violations are perceived as minimal, this area could still benefit from further improvement in enforcement.

Table 6 presents the respondents' assessment of the implementation of the local zoning ordinance in terms of enforcement mechanisms. The overall mean score of 2.97 (SD = 0.57) indicates a "High" level of effectiveness in enforcement. This suggests that respondents perceive the enforcement mechanisms of the zoning ordinance as generally adequate, with clear processes and sufficient resources to maintain compliance. However, the score also reflects some room for improvement, particularly in ensuring consistency in enforcement. Research underscores the importance of effective enforcement for zoning to be truly effective, and studies show that factors like political and social contexts play crucial roles in the success of these mechanisms (Widowaty et al., 2021; Kwon et al., 2022).

The indicator, "Enforcement mechanisms prevent unauthorized land use," had the highest mean of 3.02 (SD = 0.53), reflecting a strong agreement that the enforcement mechanisms are effective in preventing unauthorized land use. Conversely, the indicator, "There are clear processes for enforcing the zoning ordinance," had the lowest mean score of 2.89 (SD = 0.62), signaling that while processes are perceived as present, they may not be sufficiently clear or transparent. This points to an opportunity to improve communication regarding enforcement procedures to enhance public trust and compliance.

Table 6
The Respondents' Assessment of the Implementation of the Local Zoning Ordinance in terms of Enforcement Mechanisms

Items	Mean	SD	Description	Interpretation
There are clear processes for enforcing the zoning ordinance.	2.99	0.60	Agree	High
Zoning regulations are enforced uniformly across all areas.	2.96	0.58	Agree	High
Local authorities have adequate resources to enforce zoning regulations.	2.99	0.54	Agree	High
Enforcement mechanisms prevent unauthorized land use.	3.02	0.53	Agree	High
There are clear processes for enforcing the zoning ordinance.	2.89	0.62	Agree	High
Overall Mean	**2.97**	**0.57**	**Agree**	**High**

Table 7 presents the respondents' assessment of the implementation of the local zoning ordinance in terms of public awareness. The overall mean score of 2.93 (SD = 0.56) indicates a "High" level of public awareness. This suggests that respondents generally perceive a strong effort to inform the public about the zoning ordinance through various channels like forums and campaigns. However, there is room for further improvement, particularly in terms of increasing the regularity and accessibility of public forums. The literature highlights that greater public participation and understanding are essential for effective zoning, as informed communities are more likely to comply and engage in sustainable practices (Kwon et al., 2022; Shareef & Altan, 2021).

The indicator, "I am aware of the purpose of the local zoning ordinance," had the highest mean score of 2.99 (SD = 0.60), indicating strong awareness of the ordinance's purpose. However, the indicator, "Public forums on zoning are conducted regularly," had the lowest mean score of 2.80 (SD = 0.56),

suggesting that while public forums are held, they may not occur as frequently or consistently as desired. Increasing the frequency and accessibility of these forums could enhance public engagement and foster a stronger sense of community investment.

Table 7
The Respondents' Assessment of the Implementation of the Local Zoning Ordinance in terms of Public Awareness

Items	Mean	SD	Description	Interpretation
I am aware of the purpose of the local zoning ordinance.	2.99	0.60	Agree	High
Public forums on zoning are conducted regularly.	2.80	0.56	Agree	High
Residents are informed about zoning regulations through campaigns.	2.96	0.51	Agree	High
Zoning ordinance information is readily accessible to the public.	2.91	0.60	Agree	High
Public consultations were held before the implementation of the zoning ordinance.	2.97	0.50	Agree	High
Overall Mean	**2.93**	**0.56**	**Agree**	**High**

Table 8 presents the respondents' assessment of the implementation of the local zoning ordinance in terms of regulatory updates. The overall mean score of 2.95 (SD = 0.55) indicates a "High" level of satisfaction with the updates to zoning regulations. This suggests that respondents perceive the updates to be generally effective in addressing current needs and incorporating stakeholder input. However, there is room for improvement, particularly in the consistency and frequency of regulatory reviews. Strengthening the process of regulatory updates could further enhance the responsiveness and adaptability of zoning ordinances (Kwon et al., 2022; Onaiwu, 2020).

The indicator, "Zoning regulations are updated to reflect current needs and challenges," had the highest mean score of 3.02 (SD = 0.54), indicating strong agreement that the zoning regulations are responsive to contemporary demands. Conversely, the indicator, "Local government units conduct regular reviews of zoning regulations," had the lowest mean score of 2.82 (SD = 0.59), suggesting that regular reviews may not occur as frequently as needed to keep the regulations current.

Table 8
The Respondents' Assessment of the Implementation of the Local Zoning Ordinance in terms of Regulatory Updates

Items	Mean	SD	Description	Interpretation
Zoning regulations are updated to reflect current needs and challenges.	3.02	0.54	Agree	High
Stakeholders are consulted during updates to the zoning ordinance.	3.01	0.51	Agree	High
Updates to zoning regulations are communicated to the public promptly.	2.89	0.57	Agree	High
Local government units conduct regular reviews of zoning regulations.	2.82	0.59	Agree	High
Updates to zoning regulations consider environmental sustainability.	3.01	0.56	Agree	High
Overall Mean	**2.95**	**0.55**	**Agree**	**High**

Table 9 presents the respondents' assessment of the implementation of the local zoning ordinance in terms of infrastructure support. The overall mean score of 3.02 (SD = 0.55) indicates a "High" level

of satisfaction with the infrastructure supporting zoning implementation. Respondents perceive the infrastructure, such as road networks, utilities, and waste management, to be generally aligned with zoning regulations. However, improvements could be made, particularly in public transportation systems, to ensure full compliance with zoning requirements (Lee, 2020).

The indicator, "Adequate infrastructure is in place to support zoning implementation," had the highest mean score of 3.05 (SD = 0.53), signaling a strong perception of adequate infrastructure. However, the indicator, "Public transportation systems comply with zoning requirements," had the lowest mean score of 2.99 (SD = 0.58), highlighting the need for improved alignment between public transport systems and zoning regulations.

Table 9
The Respondents' Assessment of the Implementation of the Local Zoning Ordinance in terms of Infrastructure Support

Items	Mean	SD	Description	Interpretation
Adequate infrastructure is in place to support zoning implementation.	3.05	0.53	Agree	High
Road networks align with zoning regulations.	3.03	0.56	Agree	High
Utilities such as water and electricity are planned according to zoning.	3.02	0.54	Agree	High
Public transportation systems comply with zoning requirements.	2.99	0.58	Agree	High
Drainage and waste management facilities align with zoning plans.	3.01	0.53	Agree	High
Overall Mean	**3.02**	**0.55**	**Agree**	**High**

Table 10 provides a summary of the respondents' assessment of the overall implementation of the local zoning ordinance. The overall mean score of 2.99 (SD = 0.56) indicates a "High" level of implementation. The results imply that the respondents perceive the zoning ordinance's implementation to be effective across various aspects, such as compliance, enforcement, public awareness, regulatory updates, and infrastructure support. However, the slightly lower scores for public awareness and regulatory updates suggest areas for improvement, especially in terms of increasing community engagement and improving communication regarding zoning regulations. Strengthening these areas could contribute to even better compliance and more effective implementation of zoning laws in the future.

Table 10
Summary Table of the Respondents' Assessment of the Implementation of the Local Zoning Ordinance

Items	Mean	SD	Description	Interpretation
Compliance Level	3.07	0.56	Agree	High
Enforcement Mechanisms	2.97	0.57	Agree	High
Public Awareness	2.93	0.56	Agree	High
Regulatory Updates	2.95	0.55	Agree	High
Infrastructure Support	3.02	0.55	Agree	High
Overall Mean	**2.99**	**0.56**	**Agree**	**High**

3. How do the respondents assess the land use efficiency in terms of:

3.1. Optimal Land Utilization;

3.2. Environmental Sustainability;
3.3. Urban Density Management;
3.4. Accessibility and Connectivity; and
3.5. Economic Productivity

Table 11 presents the respondents' assessment of land use efficiency in terms of optimal land utilization. The overall mean score of 3.00 (SD = 0.52), categorized as "Agree," indicates an "Efficient" level of land use within the community. Respondents perceive that land in their locality is being used effectively according to its designated purpose, with minimal idle or underutilized land. The zoning regulations are viewed positively for promoting optimal land use across agricultural, residential, and commercial zones. However, the lowest-rated item, "Land in my area is used efficiently according to its designated purpose" (mean = 2.95, SD = 0.59), suggests that while land use is considered efficient, there may still be room for improvement, particularly in areas where zoning regulations can be adjusted or enhanced.

Table 11
The Respondents' Assessment of Land Use Efficiency in Terms of Optimal Land Utilization

Items	Mean	SD	Description
Land in my area is used efficiently according to its designated purpose.	2.95	0.59	Agree
There is minimal idle or underutilized land in my locality.	2.98	0.54	Agree
Zoning regulations promote optimal land use.	3.02	0.53	Agree
Agricultural land is protected from urban encroachment.	3.04	0.46	Agree
Residential and commercial zones are balanced for community needs.	3.02	0.50	Agree
Overall Mean	**3.00**	**0.52**	**Agree**

Table 12 presents the respondents' assessment of land use efficiency in terms of environmental sustainability. The overall mean of 2.99 (SD = 0.53) corresponds to the description "Agree," indicating an "Efficient" level of sustainability in land use practices. Respondents generally perceive that land use policies prioritize environmental sustainability, including green space maintenance and promoting sustainable farming practices. The highest-rated items, "Land use plans prioritize environmental conservation" and "Land use policies promote sustainable farming practices," both scored a mean of 3.03 (SD = 0.50 and 0.53, respectively), demonstrating strong support for sustainability-focused zoning. The lowest-rated item, "Green spaces and parks are well-maintained in urban areas" (mean = 2.93, SD = 0.53), suggests that while there is general satisfaction with the maintenance of green spaces, improvements can still be made to ensure they are well-maintained and adequately expanded.

Table 12
Respondents' Assessment of Land Use Efficiency in Terms of Environmental Sustainability

Items	Mean	SD	Description
Land use plans prioritize environmental conservation.	3.03	0.50	Agree
Green spaces and parks are well-maintained in urban areas.	2.93	0.53	Agree
Zoning ordinances include guidelines for reducing environmental degradation.	2.96	0.55	Agree
Land use policies promote sustainable farming practices.	3.03	0.53	Agree
Land development projects comply with environmental standards.	2.98	0.54	Agree
Overall Mean	**2.99**	**0.53**	**Agree**

Table 13 presents the respondents' assessment of land use efficiency in terms of urban density management. The overall mean of 2.97 (SD = 0.51) indicates a "High" level of efficiency in urban density management. Respondents view zoning regulations as effective in managing urban density, helping to prevent overcrowding and maintaining balance in land use. The highest-rated item, "Urban density is effectively managed through zoning regulations" (mean = 3.05, SD = 0.53), suggests that zoning regulations play a significant role in controlling urban density. However, the lowest-rated item, "High-density areas are supported by adequate infrastructure" (mean = 2.89, SD = 0.58), points to concerns about the adequacy of infrastructure in high-density areas, suggesting that improvements are needed to support growing populations in these zones.

Table 13
The Respondents' Assessment of Land Use Efficiency in Terms of Urban Density Management

Items	Mean	SD	Description
Urban density is effectively managed through zoning regulations.	3.05	0.53	Agree
High-density areas are supported by adequate infrastructure.	2.89	0.58	Agree
Mixed-use developments reduce urban sprawl.	2.92	0.51	Agree
Vertical developments are encouraged to optimize land use.	3.03	0.41	Agree
Urban density regulations balance population growth and resource availability.	2.98	0.51	Agree
Overall Mean	**2.97**	**0.51**	**Agree**

Table 14 presents the respondents' assessment of land use efficiency in terms of accessibility and connectivity. The overall mean score of 3.00 (SD = 0.53) indicates an "Efficient" level of connectivity in land use practices. Respondents believe that land use planning effectively supports transportation connectivity and accessibility. The highest-rated item, "Land use plans ensure efficient transportation connectivity" (mean = 3.06, SD = 0.48), shows that respondents view zoning regulations positively in terms of minimizing congestion and promoting sustainable urban mobility. However, the lowest-rated item, "Pedestrian pathways and bike lanes are available in urban zones" (mean = 2.96, SD = 0.58), suggests that there are opportunities for improvement in expanding and enhancing pedestrian and bike infrastructure.

Table 14
The Respondents' Assessment of Land Use Efficiency in Terms of Accessibility and Connectivity

Items	Mean	SD	Description
Land use plans ensure efficient transportation connectivity.	3.06	0.48	Agree
Public transport systems are well-integrated with urban areas.	2.99	0.55	Agree
Pedestrian pathways and bike lanes are available in urban zones.	2.96	0.58	Agree
Land use ensures accessibility for persons with disabilities.	3.01	0.54	Agree
Urban areas are designed to minimize travel time between zones.	3.00	0.51	Agree
Overall Mean	**3.00**	**0.53**	**Agree**

Table 15 presents the respondents' assessment of land use efficiency in terms of economic productivity. The overall mean score of 3.04 (SD = 0.50) indicates an "Efficient" level of economic productivity. Respondents generally perceive zoning regulations as supportive of economic growth and local businesses. The highest-rated item, "Zoning regulations enhance local economic productivity" (mean

= 3.07, SD = 0.50), suggests strong support for the economic benefits of zoning. However, the lowest-rated item, "Commercial zones are planned to maximize economic benefits" (mean = 3.01, SD = 0.52), indicates that while commercial zones are viewed positively, there may still be opportunities for improvement in maximizing their economic potential.

Table 15
The Respondents' Assessment of Land Use Efficiency in Terms of Economic Productivity

Items	Mean	SD	Description
Zoning regulations enhance local economic productivity.	3.07	0.50	Agree
Commercial zones are planned to maximize economic benefits.	3.01	0.52	Agree
Land use plans consider the needs of small and medium enterprises.	3.03	0.48	Agree
Industrial zones are effectively located to support economic growth.	3.05	0.50	Agree
Mixed-use developments contribute to economic vibrancy.	3.02	0.52	Agree
Overall Mean	**3.04**	**0.50**	**Agree**

Table 16 presents the summary table of the respondents' assessment of land use efficiency. The overall mean of 3.00 (SD = 0.52) corresponds to the description "Agree," indicating an "Efficient" level of land use efficiency across the assessed areas. The results suggest that respondents perceive land use practices in their locality as generally effective, with strengths in optimal land utilization, environmental sustainability, and economic productivity. However, urban density management and accessibility/connectivity show slightly lower scores, indicating areas where improvements can be made to enhance overall land use efficiency.

Table 16
Summary Table of the Respondents' Assessment of Land Use Efficiency

Items	Mean	SD	Description
Optimal Land Utilization	3.00	0.52	Efficient
Environmental Sustainability	2.99	0.53	Efficient
Urban Density Management	2.97	0.51	Efficient
Accessibility and Connectivity	3.00	0.53	Efficient
Economic Productivity	3.04	0.50	Efficient
Overall Mean	**3.00**	**0.52**	**Efficient**

In conclusion, respondents generally perceive land use efficiency in the municipality as "Efficient" across all assessed areas, with particular strengths in promoting economic productivity and supporting environmental sustainability. However, areas such as urban density management and accessibility could benefit from further improvements to optimize land use and achieve sustainable urban growth.

4. Is there a significant difference in land use efficiency when grouped according to their profile?

Table 17 depicts the significant difference in the respondents' land use efficiency when grouped according to their profile. The data revealed that **civil status** (t-value = 0.776, p-value = 0.048) shows a significant difference. This indicates that the null hypothesis, which states that there is no significant difference in land use efficiency when respondents are grouped by civil status, is rejected since the p-value is less than 0.05. Therefore, civil status plays a role in shaping perceptions of land use efficiency.

On the other hand, sex (t-value = 0.613, p-value = 0.090) revealed no significant difference. Thus, the null hypothesis is failed to rejected for this category, suggesting that land use efficiency is perceived similarly regardless of respondents' sex. This implies that gender does not influence how respondents evaluate land use practices.

The findings suggest that civil status influences perceptions of land use efficiency, likely reflecting differing priorities or experiences between single and married respondents. Meanwhile, the lack of a significant difference based on sex suggests that both male and female respondents share comparable views on land use efficiency. These results highlight the importance of considering **civil status** when designing and implementing land use policies to ensure more inclusive planning strategies that meet the diverse needs of different demographic groups (Bhattacharyya et al., 2020).

Table 17
Test of Significant Difference of the Respondents' Land Use Efficiency when Grouped According to Profile

Profile	Category	Mean	SD	t-value	p-value	Decision on Ho	Remarks
Sex	Male	3.12	0.39	0.613	0.090	Failed to Reject	Not Significant
	Female	3.10	0.34				
Civil Status	Single	3.12	0.39	0.776	0.048	Rejected	Significant
	Married	3.09	0.33				

Significant if p-value <0.05
Legend: Ho is rejected if Significant, Ho is failed to reject if Not Significant

Regarding the Test of Difference in ANOVA, the results indicate significant differences in land use efficiency when respondents are grouped according to age and education.

For age, the ANOVA test indicates a significant difference (F-value = 3.924, p-value = 0.048). The null hypothesis is rejected, meaning that land use efficiency differs significantly across different age groups. Respondents aged 23-27 have the highest mean score (3.18), suggesting that younger respondents perceive land use efficiency more positively than other age groups. This could reflect increased awareness or engagement in sustainability practices, as younger generations tend to be more environmentally conscious and involved in sustainability-related issues (Savari et al., 2023). Previous research has emphasized that younger people are often at the forefront of environmental activism, seeking to address challenges such as land use inefficiency (D'Uggento et al., 2023).

Table 18
Test of Significant Difference in Land Use Efficiency by Age and Education

Profile	Category	Mean	SD	F-value	p-value	Decision on Ho	Remarks
Age	18-22	3.00	0.00	3.924	0.048	Rejected	Significant
	23-27	3.18	0.43				
	28-32	3.11	0.32				
	33-37	3.02	0.31				
	38 and older	3.12	0.41				
Education	High School	3.10	0.30	6.256	0.000	Rejected	Significant
	Undergraduate Degree	3.11	0.43				
	Masteral Degree	3.10	0.30				
	Doctoral Degree	4.00	0.00				

Significant if p-value <0.05
Legend: Ho is rejected if Significant, Ho is failed to reject if Not Significant

For education, the ANOVA results show a significant difference (F-value = 6.256, p-value = 0.000), leading to the rejection of the null hypothesis. The group with the highest mean score is those with a doctoral degree (4.00), indicating that individuals with higher educational attainment perceive land use efficiency more positively. This suggests that education plays a significant role in shaping individuals' perceptions of land use efficiency. Respondents with advanced degrees are likely more informed about urban planning and environmental issues, contributing to their more favorable view of land use practices (Redding, 2023). Research has found that individuals with higher educational qualifications tend to be more aware of the complexities of land use and its impact on sustainability (Zhang et al., 2021).

In conclusion, the findings suggest that age and education significantly influence how respondents perceive land use efficiency. Younger individuals (especially those aged 23-27) and those with higher educational levels (particularly those with doctoral degrees) tend to have a more positive assessment of land use practices. This highlights the importance of targeting these demographic groups with policies that emphasize the importance of sustainable land use and environmental responsibility. Additionally, the findings suggest that raising awareness and education among older age groups and individuals with lower educational backgrounds could improve their understanding of land use efficiency and lead to more favorable perceptions and behaviors.

5. Does the implementation of the local zoning ordinance influence land use efficiency?

Table 19 explains the influence of local zoning ordinances on land use efficiency. The study shows that land use efficiency is impacted by Compliance Level (0.132), Enforcement Mechanisms (0.109), Public Awareness (0.136), Regulatory Updates (0.260), and Infrastructure Support (0.425). The results indicate that Infrastructure Support has the strongest positive influence on land use efficiency, followed by Regulatory Updates, Public Awareness, Enforcement Mechanisms, and Compliance Level.

Moreover, with a per-unit increase in Compliance Level, there is a 0.132 increase in land use efficiency, suggesting that stricter compliance requirements may have unintended consequences if not balanced with supportive measures. A per-unit increase in Enforcement Mechanisms results in a 0.109 increase, demonstrating the importance of effective enforcement. Similarly, Public Awareness leads to a 0.136 increase, underscoring the role of education and outreach. Regulatory Updates contribute a 0.260 increase, reflecting the necessity of keeping zoning ordinances up to date to align with evolving land use demands. Infrastructure Support, with the highest coefficient of 0.425, highlights its critical role in enhancing land use efficiency through investments in facilities and services that support development.

The fitted regression model for Model 1 is expressed as follows:

$$\hat{Y} = 0.667 + 0.132\ X1 + 0.109\ X2 + 0.136\ X3 + 0.260\ X4 + 0.425\ X5$$

Where:
$\hat{Y}$ = Land Use Efficiency
X1 = Compliance Level
X2 = Enforcement Mechanisms
X3 = Public Awareness
X4 = Regulatory Updates
X5 = Infrastructure Support

This suggests that land use efficiency is influenced by a combination of factors, with Infrastructure Support emerging as the most significant driver. This emphasizes the importance of well-planned and maintained physical infrastructure in enabling efficient land use. Regulatory Updates also play a critical role by ensuring that zoning ordinances remain relevant and effective. Public Awareness highlights the value of informed communities in fostering efficient land use practices. Enforcement Mechanisms, while significant, indicate the need for balanced implementation. Moreover, the lower coefficient for Compliance Level suggests challenges or inefficiencies associated with overly strict or burdensome compliance requirements, calling for a nuanced approach to zoning regulations.

The regression analysis for Model 2 reveals that the implementation of the local zoning ordinance significantly influences land use efficiency. This is supported by the standardized coefficient (β) of 0.592. This positive relationship suggests that the effective implementation of zoning ordinances plays a critical role in enhancing land use efficiency. The high t-value and statistically significant p-value reinforce the importance of properly applying zoning ordinances to achieve optimal land use outcomes.

The adjusted R^2 value of 0.348 indicates that 34.8% of the variance in land use efficiency can be explained by the implementation of local zoning ordinances. This highlights the significant role of zoning ordinances, while suggesting the influence of other factors not included in the model.

The ANOVA results, with an F-value of 202.946 and a p-value of .000, further support the validity of the model. The high F-value demonstrates that the regression model is statistically significant, confirming the meaningful influence of the implementation of zoning ordinances on land use efficiency.

The fitted regression model for Model 2 is expressed as follows:

$$\hat{Y} = 1.375 + 0.565\ X1$$

Where:
$\hat{Y}$ = Land Use Efficiency
X1 = Implementation of the Local Zoning Ordinance

Table 19
Linear Regression Analysis of Local Zoning Ordinance Influence on Land Use Efficiency

Model	Predictors	Unstandardized Coefficients	Standardized Coeff. (β)	t-value (p-value)	Interpretation
Model 1	(Constant)	0.667		6.479 (0.000)	Significant
	X1: Compliance Level	0.132	-0.162	3.580 (0.000)	Significant
	X2: Enforcement Mechanisms	0.109	0.146	3.402 (0.000)	Significant
	X3: Public Awareness	0.136	0.175	4.161 (0.000)	Significant
	X4: Regulatory Updates	0.260	0.276	6.228 (0.000)	Significant
	X5: Infrastructure Support	0.425	0.479	10.921 (0.000)	Significant
	Adjusted R^2	**0.632**		**ANOVA: F = 128.018, p = 0.000**	**Statistically significant**
Model 2	(Constant)	1.375		11.210 (0.000)	Significant
	X1: Implementation of Local Zoning Ordinance	0.565	0.592	14.246 (0.000)	Significant
	Adjusted R^2	**0.348**		**ANOVA: F = 202.946, p = 0.000**	**Statistically significant**

6. What environmental plan can be enhanced to improve the implementation of the local zoning ordinance?

Table 20 illustrates the environmental plan that can be enhanced to improve the implementation of the local zoning ordinance. It provides an overview of strategies and initiatives that can be improved or implemented to enhance the effectiveness of the local zoning ordinance:

Table 20
Environmental Plans to Enhance the Implementation of the Local Zoning Ordinance

Dimension	Identified Needs for Improvement
Compliance Level	Strengthen monitoring systems to maintain and increase compliance with zoning laws.
Enforcement Mechanisms	Develop more robust enforcement mechanisms and ensure adequate resources for implementation.
Public Awareness	Increase public education campaigns about zoning regulations and their environmental impact.
Regulatory Updates	Regularly review and update zoning ordinances to adapt to evolving environmental needs.
Infrastructure Support	Invest in green infrastructure to support sustainable zoning practices and reduce environmental risks.
Overall Implementation	Combine all strategies to create a comprehensive plan for sustainable zoning ordinance implementation.

The study found that the implementation of local zoning ordinances has a significant impact on land use efficiency. Among the key variables influencing land use efficiency, Infrastructure Support emerged as the most significant factor. The findings highlight the need for municipalities to prioritize investments in infrastructure, ensure regular regulatory updates, and raise public awareness to promote efficient land use. Furthermore, effective enforcement and balanced compliance requirements are essential in maintaining land use efficiency. The study also underscores the importance of continuous review and enhancement of zoning ordinances to adapt to evolving urban needs, promoting sustainable land use practices for the long term.

CONCLUSION

The findings of the study indicate that the implementation of local zoning ordinances has a significant positive impact on land use efficiency in Garcia Hernandez, Bohol. The study demonstrates that factors such as infrastructure support, regulatory updates, public awareness, enforcement mechanisms, and compliance levels contribute to varying degrees in enhancing land use efficiency, with infrastructure support having the strongest influence. This outcome aligns with and supports the theoretical frameworks utilized in the study.

The Bid Rent Theory is validated as zoning ordinances optimize land allocation by aligning land use with economic productivity, as reflected in the efficient utilization of land resources. The findings also resonate with the Tragedy of the Commons, as the enforcement of zoning regulations mitigates overuse and mismanagement of shared resources, promoting sustainability and reducing the risk of land degradation. Similarly, the Concentric Zone Theory is supported by evidence of improved urban density management and accessibility, indicating that zoning ordinances help organize land use in a structured and efficient manner, often prioritizing functional zones that reduce urban sprawl and improve connectivity.

Overall, the study concludes that the effective implementation of local zoning ordinances significantly enhances land use efficiency, supporting the theoretical models used while emphasizing the importance of regulatory and infrastructure frameworks in achieving sustainable land management.

Recommendations

Based on the findings and conclusions, the following recommendations are given:

1. Business owners and entrepreneurs might explore opportunities that align with zoning ordinances to maximize economic productivity while ensuring compliance. They may invest in sustainable business practices that complement efficient land use and adhere to environmental sustainability principles.
2. Community residents may actively participate in awareness programs and consultations related to zoning ordinances to better understand their impact. Engaging in these activities might help residents align their land use practices with local policies, contributing to the community's overall efficiency and sustainability.
3. Environmental advocates might leverage these findings to promote stricter enforcement of zoning regulations that prioritize sustainability. They may also collaborate with local governments to educate the public on the long-term environmental benefits of efficient land use and sustainable practices.
4. Local Government Unit (LGUs) might consider strengthening infrastructure support and regularly updating regulatory frameworks to enhance the impact of zoning ordinances. They may also expand public awareness campaigns to improve compliance and support from various stakeholders, ensuring zoning efforts align with community development goals.
5. Real estate developers may align their projects with zoning ordinances to promote structured growth and efficient land utilization. They might also incorporate innovative designs that balance urban density with environmental sustainability, contributing to both economic and ecological objectives.
6. Urban and regional planners might use these findings to refine zoning strategies, focusing on areas like infrastructure support, public awareness, and compliance. They may also collaborate with stakeholders to create more inclusive, sustainable, and economically productive zoning plans that reflect the community's unique needs and characteristics.

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