The Downgrade of Bilbao, Spain's Leading Smart City

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Abstract. This article aims to analyse the main variables responsible for the downgrade in the ranking of Bilbao in Spain as the top smart city, according to the International Institute for Management Development (IMD) index. The factors that will undergo rigorous study are those that contribute to either improvement or exacerbation between 2019 and 2023. The objective is to identify the primary causes for the decline in Bilbao's ranking places. This research may be of interest to cities seeking to enhance the quality of life for its residents by gaining insights from this report. This study examines the primary enhancements and failures that the city has implemented in certain areas. Gaining knowledge on how to prevent these failures and implementing enhancements in future urban areas is significant and remarkable.

Keywords: Smart city · Urban · Sustainability · Health and safety · Mobility · Technology · Governance · Liveable

1 Introduction

A smart city is a place where human and social capitals as well as a robust communication infrastructure (ICT) contribute to both economic progress and an improved quality of life and happiness of people [1–7]. A city is also smart where individuals can conveniently access all necessary destinations by either walking or using environmentally friendly public transportation. A smart city is also characterised by its devotion not only to competitiveness [8], but also to sustainability, prioritising environmental care and demonstrating knowledge of its own pollution emission [9]. Various research across several disciplines attempted to provide a clear definition of a smart city by identifying and categorising its associated factors and features. Nevertheless, the literature concurs in delineating the key aspects that a smart city must encompass, namely an effective health and safety infrastructure, a well-functioning public transport system, engaging recreational options and environmentally friendly areas for the residents, provisions for job seeking and educational grants, and a responsible and open governance.

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In their study, Harrison et al. [10] provided a definition of a smart city, as the need to increase the urban smartness, by integrating its physical, social, commercial, and information communication technology (ICT) infrastructure. Kondepudi [11] defines a smart city as a modern city that needs ICT to enhance the quality of life and public services for its citizens. These two definitions illustrate that a smart city is a technologically advanced urban environment that incorporates information and communication technology (ICT) to enhance everyday activities and the well-being of its residents. However, the current idea of "smart cities" has become associated with city rankings, which serve as the most influential and efficient tool for driving economic, social, and spatial developments in cities. Giffinger et al. [12] provided an initial definition of a smart city as the integration of i) ICT, ii) data, iii) actions taken by decision makers, iv) economy and v) the well-being of the residents themselves. This integration leads to a sustainable development over time and encompasses six key pillars: Smart Economy (competitiveness), Smart People (social and human capital), Smart Governance (participation), Smart Mobility (transport and ICT), Smart Environment (natural resources) and Smart Living (quality of life).

The "smart cities" concept proposed by Dashkevych et al. [13] encompasses various identification criteria that include the key aspects of sustainable development (environment, society, economy, and technology). These criteria are directly linked to enhancing the overall quality of life for citizens. The suggested classification [14] differs from traditional Smart Cities categorizations, in which some categories contain more metrics than others, and many metrics are general technological measures not directly related to human well-being. Correia et al. [15] propose composite indicators to define and classify a smart city, firstly based on the respective smart city category of the projects (ultimately related to the smart city conception phase) and secondly considering the population density of each area (organised by classes). This prevents smaller cities from often being overlooked and disregarded when discussing smart cities. The ranking incorporates both smaller and medium cities, emphasising the notion that significant choices made in smaller cities may have a greater influence than those made in medium cities. This approach introduces new insights to the ongoing debate on the essential characteristics of a smart city. City rankings are important because they serve as a tool that depends on urban expertise and the capacity to use the findings efficiently. City rankings are a valuable and efficient tool for guiding economic, social, and spatial processes in cities. They provide recommendations for researchers and analysts involved in the design and methodology of city rankings, as well as for local governments and stakeholders regarding the reasonable management of the results [16].

Starting from assumptions, this study aims to evaluate the reasons for Bilbao's decline in the International Institute for Management Development (IMD) smart city index, specifically examining the causes for its shift from being the leading smart city in Spain to the 27th best in the world. To achieve these goals, the paper is organised as follows: section two describes the case study, the third section explains the methodology, the fourth part analyses the results and finally, a general conclusion will be described.

2 Case Study

Bilbao, situated in the northern part of Spain (Fig. 1), is the most densely populated city in the province of Bizkaia and in the Basque region. Additionally, it is the biggest city in northern Spain and the tenth-largest city in the country, with a population of 347,000 residents (2023), resulting in a density of 8,339 inhabitants per square kilometre.

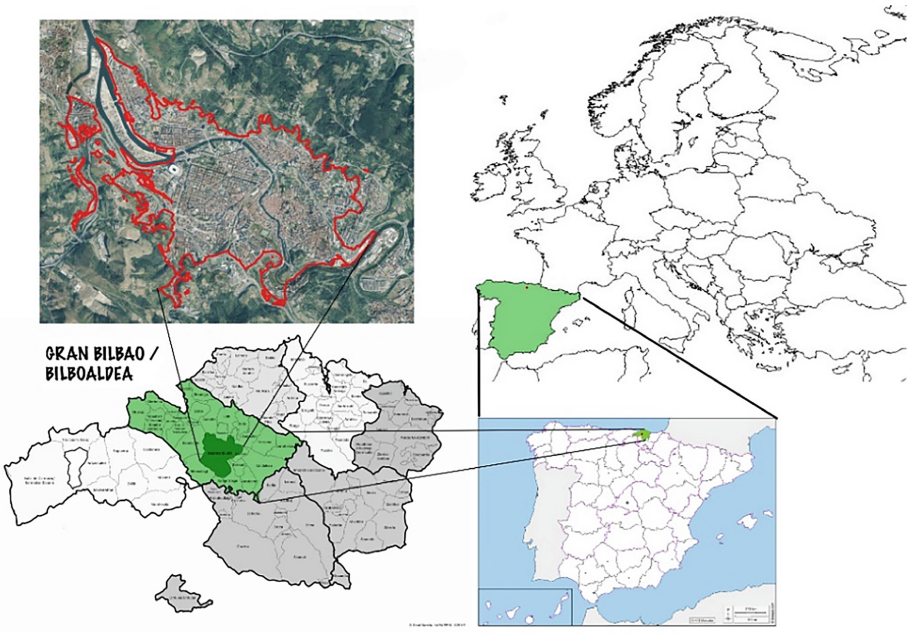

Fig. 1. Map of Europe, Spain, Province of Bizkaia and finally the city of Bilbao.

Furthermore, considering the metropolitan region, the population significantly grows, surpassing one million residents. Recent data from the Spanish National Statistics Institute reveals that Bilbao covers an area of approximately 41 km^2. Although Bilbao is relatively small in size, it serves as a crucial focal point for cultural, economic, and political endeavours in the Basque Country. The city is geographically positioned about 14 km to the south of the Bay of Biscay, providing direct access to the Atlantic Ocean. This geographical advantage greatly strengthens its importance as a marine gateway. The urban environment of Bilbao is characterised by its cutting-edge infrastructure, prominently including the world-famous Guggenheim Museum. This architectural masterpiece serves as a symbol of the city's dedication to contemporary design and cultural revitalisation.

This paper examines a Spanish city due to the European Union's designation of the Iberian Peninsula as an energy island with the ability to meet its own energy needs. Consequently, the towns in this region are prime candidates to become highly advanced smart cities.

Bilbao is an ideal city in Spain for promoting and implementing green infrastructures and technology due to its optimal size, which may serve as a model for other cities. It has also the potential to serve as an ideal urban environment for testing and evaluating innovative technologies on a smaller scale. The tables below (Table 1 and Table 2) show the IMD smart city index rankings for 2019 and 2023, highlighting the decline of Bilbao in the rankings and identifying the new cities that have surpassed Bilbao. A more comprehensive study of the ranking will be conducted later in the methodological approach section.

Table 1. IMD Smart City Index 2019 [17]

IMD Smart City Index 2019			
1. Singapore	4. Geneva	6. Auckland	8. Helsinki
2. Zurich	5. Copenhagen	7. Taipei City	9. **BILBAO**
3. Oslo			10. Dusseldorf

Table 2. IMD Smart City Index 2023 [18]

IMD Smart City Index 2023			
1. Zurich	8. Helsinki	15. Amsterdam	22. Auckland
2. Oslo	9. Geneva	16. Seoul	23. Wellington
3. Camberra	10. Stockholm	17.Dubai	24. Brisbane
4. Copenhagen	11. Hamburg	18. Sydney	25. Shanghai
5. Lausanne	12. Beijing	19. Hong Kong	26. Reykjavik
6. London	13. Abu Dhabi	20. Munich	27. **BILBAO**
7. Singapore	14. Prague	21. New York	28. Vienna

In order to properly understand the ranking, it is important to be aware of the specific parameters used by the IMD index to categorise the cities included in the ranking. After analysing the particular variables surrounding each indicator associated with the cities, a comparison will be conducted to identify any changes that have impacted the city of Bilbao over the past few years. This analysis aims to provide justification for the city's decline in the ranking. The analysis will provide a logical explanation for the fluctuations in indicators that have occurred due to changes in government and extraordinary circumstances over the past four years. The most prominent instance is the COVID-19 pandemic, which had a significant impact on the economies and politics of all governments and cities worldwide.

3 Methodological Approach

Rankings are an effective method for assessing smart cities because they provide an evaluation of the fundamental concept and its first development. Additional rankings, such as the IESE Cities in Motion Index conducted by the University of Navarra, as well as others conducted by various institutions, exist. This study uses the IMD rank due to its comprehensive analysis of a larger number of metrics and cities compared to other rankings. The research focused on particular ranking indicators that have the greatest impact on Bilbao's decline in position. These indicators are closely aligned with the goal of prioritising the evaluation of citizen well-being.

Bilbao ranked 9th in the IMD Smart City Index 2019, conducted by the prestigious IMD World Competitiveness Centre, a leading business school in Switzerland that is globally recognised. Bilbao is among the top cities on this ranking, surpassing places such as Singapore (1), Zurich (2), Oslo (3), Geneva (4), Copenhagen (5), Auckland (6), Taipei (7), Helsinki (8), and Dusseldorf (10).

The latest research of 2023 studied 141 cities (compared to 118 cities in 2019) and examined the perceptions of 120 inhabitants to assess the cities. Bilbao has dropped to the 27th place in this position.

The World Talent Ranking assesses the degree to which economies experience growth, attract, and retain highly skilled employees. In an ever-changing world where artificial intelligence, robots, and other emerging technologies are reshaping current and future challenges for business, policy makers, and educational institutions, fostering a skilled and knowledgeable workforce enhances competitiveness and fosters sustainable prosperity in the long run. The determination of the criteria for defining a smart city is crucial due to the expected ongoing advancements in technology, which will provide new solutions to urgent global issues such as climate change, inequality, health, and education. However, due to their intricate nature and reliance on insufficient or inconsistent information, these choices can pose difficulties for officials from municipalities, investors, and residents.

IMD Smart City Index Main Parameters:

Health and Safety: The healthcare system in the Basque Country ranks as the second highest-performing in Spain. Nevertheless, after the COVID-19 pandemic, assessments within the healthcare system have declined. Regarding the waiting lists, those in the Basque Country are among the most compact in Spain. The ratio of health professionals to residents is 4.85 staff members per 1,000 persons. The overall feeling of security experienced by inhabitants in this city, as in other parts of the globe, is dependent on the specific neighbourhood they find themselves in. On average, the people of Bilbao rate their city with a score over 6. The poll revealed that over 90% of respondents reported no instances of criminal activity inside the city in the last 4 months. Regarding police efficacy, a majority of over 45% of residents expressed their intention to contact the municipal police, while about 40% said their preference for contacting the Ertzaintza.

Mobility: Bilbao has the most efficient public transport system in Spain, outperforming bigger cities such as Madrid or Barcelona, despite their larger size and population. Private transport is rarely utilised in this city and its predominant mode of transportation

is the underground. The transport system consists of three primary routes that link the outside districts with the city core. It is also capable of facilitating transportation to other communities within the province. In terms of bus transportation, this city has a network of 43 routes and over 500 strategically located stations.

Activities: Bilbao has lately acquired a significant number of green areas for its residents. In the last year, the city has added almost 20,000 m^2 of natural areas, together with 1500 newly planted trees that create a green belt around the city. The municipal government declared that they had opened up 10,873 m^2 of grounds. The government plans also to include 12,566 m of additional green areas with the implementation of the Master Urban Plan in March. The areas are now in various stages of development. The construction of 3,392 m^2 of gardens in the Pinar de Zorroza group is nearing completion, and an additional 3,464 m^2 will be obtained from various plots in San Ignacio. Regarding cultural activities, residents seem satisfied with the IMD ratings during the years.

Opportunities (Work and School): The Bilbao City Council has implemented new procedures for the recruitment of additional staff. The youth employment strategy aims to enhance their prospects in this area. Bilbao Ekintza, a municipal company that aims to promote the generation of economic and social wealth for Bilbao, develops pragmatic training initiatives as part of the Employment Plan and Youth Employment Plan, aiming to enhance the competencies of unemployed persons engaged in these programmes. The objective is to stimulate job creation and economic growth in Bilbao by adhering to the principles of sustainability, innovation, and collaboration. This will involve prioritising the city's strategic sectors while also focusing on talent retention and development. Additionally, efforts will be made to bridge the gap between young people and the labour market by aligning their personal and professional skills with the needs of businesses.

Governance: The government's official website offers people opportunities to access information and have a comprehensive understanding of how their taxes are being used. Additionally, they consider whether the government values the opinions of its people. Table 3 illustrates the fluctuations in Bilbao's rates from 2019 to 2023, excluding the rank for 2022, according to several elements of the IMD smart city index.

4 Results

This section of the paper examines the reasons for the IMD index's drop from 2019 to 2023. Because these are some of the variables that have either improved or become worse in Bilbao over the past five years, the study analyses them. In addition, as they are the most crucial markers to guarantee inhabitants a decent standard of living.

A. Decline in the Quality of Healthcare Services.

The medical care in Bilbao has declined, as reported by the interviewed people, as a result of reductions in government funding. Research conducted by the Euskadi medical union (EMU) reveal that the COVID-19 crisis has significantly exacerbated the previously existing condition in the community, as shown in 2019 [21].

The main difficulties faced by people include the scarcity of new family physicians in the healthcare system, resulting in a higher number of retiring doctors compared to those entering the profession after graduation [22].

Table 3. IMD Smart City Index 2019 (p. 36) [17], IMD Smart City Index 2020 (p. 26) [19], IMD Smart City Index 2021 (p. 26) [20], IMD Smart City Index 2023 (p. 52) [18].

INDICATOR	Meanings	BILBAO				
STRUCTURES		2019	2020	2021	2022	2023
Health & Safety						
Basic sanitation meets the needs of the poorest areas	If the communities where residents who are in weaker financial circumstances move are equally clean	74.59	77.3	77.4		76.4
Recycling services are satisfactory	If the city has facilities to handle the trash and a good system to assist residents in recycling	77.05	77.7	74.3		76.0
Public safety is not a problem	Is it safe to walk at night in every street and neighbourhood and if there is enough police	59.70	64.3	64.3		62.2
Air pollution is not a problem	The quality of the air of the city is good for the health of the citizens and for the environment	51.37	53.1	52.6		50.2
Medical services provision is satisfactory	The city has enough hospitals or ambulatories to take care of all the population	75.14	78.0	75.1		69.0
Finding housing with rent equal to 30% or less of a monthly salary is not a problem	Is it possible to pay rent inside the city without using the biggest part of your monthly salary	x	27.6	27.8		25.4
Mobility						
Traffic congestion is not a problem	If the most used roads and streets have a normal traffic quantity to be able to reach your destination without congestion	43.17	44.0	47.8		47.0
Public transport is satisfactory	The public transport of the city is enough to go to all the parts of the city and it is fast. Also the frequency is good and they have a good app to help citizens to reach their destination	81.97	82.4	81.4		82.8
Activities						
Green spaces are satisfactory	The city has enough parks and trees to walk around and have a break	77.87	76.6	77.1		78.9
Cultural activities (shows, bars, and museums) are satisfactory	The city has bars, cinemas, museums, theatres to supply to the citizens cultural entertainment	81.28	80.3	80.8		84.0

(*continued*)

Table 3. (*continued*)

INDICATOR	Meanings	BILBAO				
STRUCTURES		2019	2020	2021	2022	2023
Opportunities (Work & School)						
Employment finding services are available	The city has a good system to help citizens to find jobs	74.45	73.8	75.5		75.4
Most children have access to a good school	The public schools are good enough to ensure a good education to all the children of the city. No matter how much money they have their families	78.83	78.7	76.3		76.2
Lifelong learning opportunities are provided by local institutions	If the universities or study centres are able to offer learning opportunities to the citizens during the time they live	80.60	81.0	77.4		76.2
Businesses are creating new jobs	If the businesses are creating new kinds of jobs according to the new studies and careers	54.37	50.2	49.3		50.9
Minorities feel welcome	In the city the minorities feel comfortable and don't have problems with the rest of the citizens	65.57	62.9	63.1		63.8
Governance						
Information on local government decisions is easily accessible	It is easy to know about what the government is doing or going to do with the city to improve the citizens lives	60.93	62.1	61.8		61.9
Corruption of city officials is not an issue of concern	If around the people who manage the city there is no corruption	50.14	53.1	52.6		51.6
Residents contribute to the decision making of local government	If the citizens are able to take part in the decisions for improving the city	51.37	49.3	50.1		48.4
Residents provide feedback on local government projects	If citizens are used to giving their impressions about the decisions taken by the government	61.48	58.3	56.1		54.9
TECHNOLOGIES		2019	2020	2021	2022	2023
Health and safety						
Online reporting of city maintenance problems provides a speedy solution	If the government could help the citizens using online ways, it could be faster and easier for all	59.97	60.0	54.3		55.4
A website or app allows to give away unwanted items to other city residents	If the citizens could shop or sell the things, they do not want the easier way possible	53.83	53.4	54.6		55.8

(*continued*)

Table 3. (*continued*)

TECHNOLOGIES		2019	2020	2021	2022	2023
Free public Wi-Fi has improved access to services	If the city could offer free WiFi for the citizens in public areas, for all the people to have access to it	62.16	60.4	58.4		58.7
CCTV cameras make residents feel safer	If the city has vigilance, the citizens won't be afraid of walking in the night alone or in more conflicted areas	51.09	51.2	50.1		50.3
A website or App allows effective monitoring of air pollution	If the govern could offer an App for monitoring the air pollution the citizens could choose to go to the place they prefer the most	50.00	50.5	47.3		43.2
Arranging medical appointments online has improved access	This could help the people on their medical issues and the medical system stop to be collapsed	76.50	75.2	71.0		68.0
Mobility						
Car-sharing Apps have reduced congestion	If this type of App is improved it could help with all the problems that are caused by cars, such as traffic jams, pollution…	45.22	45.3	42.5		47.2
Apps that direct you to an available parking space have reduced journey time	You can go directly to a parking lot with available places and not waste time or fuel looking for one free. It will help with the pollution and the traffic congestion too	52.05	51.3	47.8		48.6
Bicycle hiring has reduced congestion	The improve of the bicycle in the city help the environment and the traffic jams to be reduced	58.47	60.1	61.8		60.7
Online scheduling and ticket sales make public transport easier to use	The new Apps for the public transport help the people to know what bus or train they had to catch and pay it in a easier way	74.73	73.6	71.4		72.7
Activities						
Online purchasing of tickets to shows and museums has made it easier to attend	The websites of the touristic places help them to make themselves known for more people	83.33	83.5	82.7		82.5
Opportunities (Work & School)						
Online access to job listings has made it easier to find work	This kind of websites and list could help the people to find a work faster than in the traditional way	69.77	67.5	62.5		65.1

(*continued*)

Table 3. (*continued*)

TECHNOLOGIES		2019	2020	2021	2022	2023
IT skills are taught well in schools	Informatic technologies are a very important skill for the students, so if they are well teaching in the school in the future those children will had more capacity in the using of a computer	65.16	64.4	63.4		62.7
Online services provided by the city has made it easier to start a new business	The advantages of the IT (Information technologies) in the online services help the citizens in their issues when they need information about starting a new business	59.02	58.8	54.3		52.3
Governance						
Online public access to city finances has reduced corruption	The local government publishes the financial data managed by the city council, with the aim of being more transparent to citizens	46.17	44.4	41.6		41.7
Online voting has increased participation	With online voting, the number of people who want to vote has increased	43.85	46.0	42.9		42.7
An online platform where residents can propose ideas has improved city life	This online resource in which citizens can propose new ways to improve the city	58.33	59.7	58.7		56.1
Processing Identification Documents online has reduced waiting times	With the new online identification methods, people in the city avoid having to go in person and can carry out their transactions online	63.66	64.9	65.3		65.4

Healthcare professionals are reluctant to work inside the oppressive Osakidetza system (institution created in 1984 in charge of the public healthcare system in the autonomous community of the Basque Country), prompting many to transition to fields with less round-the-clock shifts, private healthcare sectors, or even seek opportunities abroad where they may get better treatment [23]. Prior to the COVID-19 epidemic, over 4,000 certificates were granted to community members for employment in foreign countries, all of whom were negatively impacted by the aforementioned issue of poor working conditions.

In addition, after the 2010 crisis that impacted the whole of Spain, the funding given to healthcare has seen a significant reduction. As of the start of 2021, a significant 58% of employees within the Basque health system were employed on temporary contracts, despite possessing over 8 years of professional experience.

In comparison to the 2019 data, the healthcare taxes allocated in the Basque Country are 2% points lower than the allocation made by the European Union. Therefore, in order to meet the European average, the healthcare budget in the Basque Country would need to be increased by 40%.

The hospital employment rate is lower compared to other European countries, with just 3.6 health professionals per 1,000 residents, whereas the European average is 8.8 per 1,000.

B. The Excessive Rental Costs for Houses.

During the previous four years the conditions and rates to rent a property in the city of Bilbao have grown unequal. The primary factor is the city's high level of tourism and the preference of citizens who own secondary homes to rent them out as tourist apartments. This allows them to generate higher income compared to renting to students or professionals who need to reside in Bilbao for educational or work-related purposes.

Additionally, the city's restricted urban space in the centre region is due to its mountainous surroundings, leaving the only viable option for expanding the metropolitan area on the opposite sides of the mountains. The demand for homes in the city centre has increased due to people's preference for living there, as it offers proximity to both their workplaces and social amenities. Consequently, this leads to an escalation in housing prices.

According to the Department of Territorial Planning, Housing and Transport of Spain, Bizkaia in Basque language has the highest number of uninhabited houses, with a total of 6707. Most of these houses are located in the metropolitan area of Bilbao. It is worth noting that these houses are primarily rented out as tourist apartments. This condition is exacerbating the rising costs of rental rates in the city. The current public administrators decided to impose taxes on homeowners whose properties are potentially rentable, beginning in 2024. In light of the tourist issue, it is more usual to see various indicators such as AT ("apartamento para uso turístico", apartment for tourist use), VT ("vivienda para uso turístico", housing for tourist use) or HT ("habitación de vivienda particular para uso turístico", room in a house for tourist use) displayed in the corridors of many downtown residences, denoting their status as tourist accommodations.

These flats are considered legal because they are controlled by the government and fulfil their tax obligations. However, the issue arises with those units that are being leased in violation of the law. The inspectors saw a discrepancy between the number of units listed on booking platforms such as AirBnb or Booking and the number of flats recorded in their system. it is expected that in the future, the flats offered for rent on the internet were 40% larger than their legally registered size and complied with the present requirements [24]. This scenario is a dual issue, both for the government and for those who lawfully rent out their tourist apartments. The absence of regulation creates a sense of insecurity, leading to a significant loss of consumers. This is mostly due to the fact that potential renters tend to choose for the cheapest options, which often happen to be the illegal ones. While the issue poses a challenge for rental property owners, it has significantly worsened over the past four years for citizens seeking to rent a house for residential purposes. Presently, it is virtually impossible to secure a house in the city centre without incurring a monthly cost of approximately 1,000 €.

The examined indicator, due to its downgrading, suggests that it is possible to rent a property while allocating less than 30% of the monthly income. Evidently, this indicator has deteriorated in 2022, because the mean rental housing price was at 1,103 € per month. Consequently, an individual earning the interprofessional minimum salary would need to dedicate 110% of their income to cover this expense.

C. Traffic Congestion Is Not Something to Worry About.

Bilbao has been actively engaged in the European Mobility Week from the year 2000. Throughout this period, the city has collaborated with the European Commission to achieve the shared goal of implementing optimal strategies to minimise automobile use and thus mitigate atmospheric and noise pollution. The capital city has successfully implemented a measure to reduce the speed limit of all its streets to 30 km per hour. This initiative has earned the city the European Union Urban Road Safety Award, which acknowledges the exceptional and innovative efforts made by local authorities in promoting road safety.

In addition to decreasing the speed limit inside the city, Bilbao has implemented a comprehensive and sustainable mobility strategy aimed at promoting longer and healthier lives for its residents. One notable project, such as "Red de caminantes" [25] or the walkers' network, has developed 15 distinct walking routes to explore Bilbao in a healthy manner. Furthermore, there are supervised walks for students to ensure their safety while commuting to and from school. Another significant initiative involves the closure of major roads in the city centre every Sunday, which were previously congested with cars, in order to promote pedestrianisation. The primary purpose of this is to provide those who have the opportunity to engage in leisurely biking, skating, or walking in the city centre, free from noise pollution and the need to be mindful of traffic. According to research conducted by OCU (Organisation of consumers and users of Spain), the public transportation system in Bilbao is ranked among the top in Spain. The study analysed timeliness and overcrowding in transportation across 21 Spanish towns [26].

Following this organisation (OCU), the tram in Spain is considered the best due to its exceptional performance in terms of punctuality, with only 6% of delays, none of which exceed two minutes. Furthermore, the tram is appreciated for its informative screens and ample available space. In addition, the municipal buses in Spain are also highly regarded, particularly in the cities of Logroño and Pamplona, as they experience a mere 21% of delays. The subterranean system has the second most favourable position in the nation, being topped only by the underground system of Malaga. Despite being somewhat delayed 17% of the time, it achieved the highest ranking in terms of agglomerations.

Another important aspect associated with the lowering of the usage of vehicles within the city is the excellent system of electric bikes, "BilbaoBizi". Bilbao has the European system with the largest bicycle utilisation. The system has had around 5 million utilisations since its establishment, surpassing any other European cities with similar services, with an average of over 20 uses per bicycle on peak hours. Prior to 2018, the service saw an average daily utilisation of 500 on traditional bicycles. By 2022, there will be many occasions when the number of uses will exceed 8,000 or 9,000.

With the addition of a cycling network spanning over 60 km in a city measuring only 41 km^2, the implementation of secure parking in municipal lots, and financial support for the acquisition of electric bicycles, the bicycle has gained significant popularity. It now stands alongside walking and public transportation as the main means of transportation in this city, where 64% of journeys are made on foot, 24% by public transportation, and 11% by car.

This system is very advantageous for intra-city transport. However, this year, the administration of Bizkaia has introduced a new system named "BizkaiBizi" with the aim of linking the neighbouring towns of the metropolitan region to the city core. The Provincial Council of Bizkaia, in collaboration with the municipalities of Barakaldo, Berango, Bilbao, Erandio, Getxo, Leioa, Portugalete, Santurtzi, and Sestao, implemented the BizkaiBizi public bicycle service. The service comprises a fleet of 650 electric bicycles, accompanied by 62 dedicated parking and charging facilities. In the future, this number will increase to 78 anchoring sites, representing the whole of the service. The issue of traffic congestion in Bilbao has significantly diminished with the government's adoption of a new legislation aimed at preserving air quality by reducing harmful emissions inside the city core. Furthermore, the bicycle rental system is implemented both inside the city and its surrounding metropolitan region. This is further enhanced by an exceptional transit and underground system.

D. The Prevalence of Unemployment Increases.

Before 2019, Bilbao's economy had considerable stability, with an unemployment rate that consistently remained below the national average of Spain. The city has evolved into a prominent centre for services, tourism, and culture, generating employment opportunities in several sectors. The employment in Bilbao was significantly influenced by the construction, industrial, and tourism industries.

A critical turning point was achieved in 2020 when the COVID-19 pandemic hit. Bilbao's position became precarious due to mobility constraints, the shutdown of non-essential businesses, and a significant downturn in tourism. Many firms were forced to cancel employment contracts or initiate staff layoffs. The sectors that saw the greatest effect were hospitality, tourism, and culture.

The implementation of pandemic containment measures had a detrimental impact on the local economy, resulting in a significant increase in the region's unemployment rate. People who had previously had secure and dependable employment unexpectedly found themselves unemployed and unable to provide financial assistance for their families. The increase in unemployment has had a significant effect on the residents of Bilbao. People who become unemployed often face financial difficulties and undergo feelings of stress and anxiety.

The uncertainty over the future and the ability to fulfil basic needs may have a significant emotional and psychological impact on individuals and their families. Furthermore, unemployment may lead to a decrease in an individual's self-assurance and confidence, which can adversely affect their mental well-being.

Rising unemployment may also engender feelings of unease and distrust towards the stability of the economy, thereby influencing individuals' choices about investment and expenditure. The local economy may see enduring repercussions from the relentless cycle of unemployment. The whole can therefore be graphically summarised in Fig. 2 in which the data for the previously mentioned items are displayed.

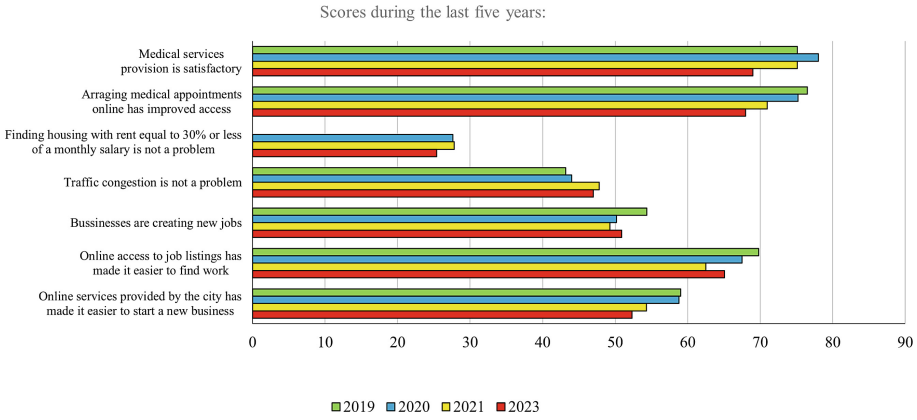

Fig. 2. Visual illustration of the indicators which are analysed from 2019 to 2023.

5 Discussions and Conclusions

This article demonstrates that between 2019 and 2023, the city of Bilbao experiences a decline in the ratings given by its residents. The first aspect is the decline in health services, mostly attributed to the COVID-19 epidemic. Additionally, the reduction in healthcare funding allocated by the state in preceding years has contributed to this situation. Another factor is the adverse working circumstances experienced by physicians, as well as the growing number of newly graduated doctors who choose to pursue their specialisation in a foreign country.

Another issue faced by the residents is the exorbitant rental prices for houses. One of the primary causes of this problem is the limited construction area in Bilbao due to its mountainous location. Additionally, individuals who own second homes in the city often choose to rent them out as vacation houses in order to maximise their profitability. The annual rental cost of the flat exceeds 30% of an individual's monthly income. The last factor that negatively impacted the ranking was the job environment, which was adversely affected by the movement restrictions imposed during the COVID-19 epidemic. Consequently, the local economy suffered significant harm.

The Vasque Government has identified many projects that might assist individuals in addressing these issues. Some of these efforts include:

Harmonise the public expenditure (GDP) of Euskadi with that of Europe by allocating a maximum of 7% of public expenditures on healthcare. Prioritise the use of public health above private health. Enhancing the scope of public health insurance and promoting its use among the population. Ensure universal access to a cost-free, high-quality healthcare system for all individuals. The objective is to provide more employment opportunities and enhance the quality of life for healthcare workers.

As to the findings of the Vasque Government observatory, if tourist residences were subject to appropriate taxation, it would alleviate the strain on the regular rental market. This would result in an increase in the number of available rental properties and a decrease in average rental costs.

The recovery has been systematic despite the allocation of resources towards economic transformation and steps to mitigate the impact. To ensure a robust and enduring recovery, it is imperative for the government, companies, and society as a whole to implement cohesive and synchronised measures to tackle the economic crisis and unemployment in Bilbao. Bilbao's economic outlook is characterised by its potential for adaptability and future resilience. The city of Bilbao has successfully alleviated traffic congestion with the construction of an exceptional public transport system, and the introduction of a new public bicycle service.

In conclusion, the decline in the ranking of Bilbao may be attributed to the issues outlined in this research, which have resulted in a decrease in their scores over the last five years. These are the primary factors contributing to the decline in rankings. Additionally, it is important to consider that in recent years, additional cities have been included in the index, resulting in a little decrease in Bilbao's place on the list.

The difficulties, potential remedies, enhancements, and conclusions outlined in this paper may serve as a valuable source of information and inspiration for other communities facing comparable circumstances. This study can contribute to conducting additional analyses to identify new indicators or modify existing ones for assessing and tracking the effects of technological innovations on the advancement of smart cities and the promotion of sustainable visions [27]. These analyses aim to address concerns related to contemporary society.

Essentially, Bilbao is an ideal city for analysis due to its compact size, which allows for a comprehensive examination of problem-solving and the implementation of innovative urban systems. After conducting an analysis of the impact of the policies implemented in Bilbao, it is possible to extrapolate their applicability to bigger European cities or specific districts within those cities.

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