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Perception of residents regarding the socioeconomic and environmental impacts of the Huambo Airport in Angola

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Abstract

Objective: This work aims to study the perception of the socioeconomic and environmental impacts of the Huambo Airport, this Angolan city and province.

Methodology: A quantitative methodology based on a questionnaire survey was used, targeting the residents of the city of Huambo. The sample consisted of 669 surveys.

Originality/Relevance: An airport structure is subject to public scrutiny as it has a significant social and economic impact. The airport is a structure that, in addition to economic and social impacts, affects the city's planning and management policy, carrying both positive and negative impacts.

Results: The results show that Huambo Airport promotes development, seeks to maintain environmental balance and preserves the surrounding nature, as well as creating local employment. An exploratory factor analysis related to the perceptions of airport impacts allowed the observation of six factors: the impact and economic growth enabled by the airport, pollution caused, the valorisation of nearby properties, job promotion, and concern for nature preservation around the airport.

Management contributions: This study is expected to contribute to the development of policies for the economic and social growth of cities. Therefore, it is believed that complementary sectors such as tourism, logistics, and commerce can benefit from the presence of the airport, along with an emphasis on professional development geared towards the airport industry.

Keywords: airport, airport impact, airport externalities, city management, transportation

Perceção dos habitantes sobre os impactos socioeconômicos e ambientais do Aeroporto do Huambo em Angola

Resumo

Objetivo: Este trabalho tem como objetivo o estudo da perceção sobre os impactos socioeconômicos e ambientais do Aeroporto do Huambo, nesta cidade e Província Angolana.

Metodologia: Foi utilizada uma metodologia quantitativa, baseada na aplicação de um inquérito por questionário, dirigido aos habitantes da cidade do Huambo. A amostra é constituída por 669 inquéritos.

Originalidade/Relevância: Uma estrutura aeroportuária está sujeita ao escrutínio da opinião pública, pois tem um impacto social e económico elevado. O aeroporto é uma estrutura, que para além de impactos económicos e sociais, afeta a política de planeamento e de gestão da cidade, carregando consigo impactos positivos e negativos.

Resultados: Os resultados permitam concluir que o aeroporto do Huambo promove o desenvolvimento, procura manter o equilíbrio ambiental e preservar a natureza circundante, bem como permite criar emprego local. A análise fatorial exploratória relacionada com as perceções dos impactos do aeroporto, permitiu a observação de seis fatores: o impacto e o crescimento económico permitido pelo aeroporto, a poluição provocada, a valorização dos imóveis próximos, a promoção do emprego, e a preocupação com a preservação da natureza junto ao aeroporto.

Contribuições sociais/para a gestão: Espera-se que este estudo possa contribuir para o desenvolvimento de políticas para o crescimento económico e social das cidades. Assim, acredita-se que setores complementares possam beneficiar da presença do aeroporto, nomeadamente o turismo, a logística e o comércio; bem como a aposta na capacitação profissional voltada para a indústria aeroportuária.

Palavras-chave: aeroporto, impacto aeroporto, externalidades aeroporto, gestão de cidades, transportes

Percepción de los habitantes sobre los impactos socioeconómicos y ambientales del Aeropuerto de Huambo en Angola

Resumen

Objetivo: El objetivo de este trabajo es estudiar la percepción sobre los impactos socioeconómicos y ambientales del Aeropuerto de Huambo en esta ciudad y provincia de Angola.

Metodología: Se utilizó una metodología cuantitativa basada en la aplicación de una encuesta por cuestionario dirigida a los habitantes de la ciudad de Huambo. La muestra está compuesta por 669 encuestas.

Originalidad/Relevancia: Una estructura aeroportuaria está sujeta al escrutinio de la opinión pública, ya que tiene un impacto social y económico elevado. El aeropuerto es una estructura que, además de tener impactos económicos y sociales, afecta la política de planificación y gestión de la ciudad, con impactos positivos y negativos.

Resultados: Los resultados permiten concluir que el aeropuerto de Huambo promueve el desarrollo, busca mantener el equilibrio ambiental y preservar la naturaleza circundante, así como permite crear empleo local. El análisis factorial exploratorio relacionado con las percepciones de los impactos del aeropuerto permitió la observación de seis factores: el impacto y el crecimiento económico permitido por el aeropuerto, la contaminación provocada, la valorización de los inmuebles cercanos, la promoción del empleo y la preocupación por la preservación de la naturaleza junto al aeropuerto.

Contribuciones sociales/para la gestión: Se espera que este estudio pueda contribuir al desarrollo de políticas para el crecimiento económico y social de las ciudades. Por lo tanto, se cree que sectores complementarios pueden beneficiarse de la presencia del aeropuerto, como el turismo, la logística y el comercio; así como la inversión en capacitación profesional orientada a la industria aeroportuaria.

Palabra clave: aeropuerto, impacto aeroportuario, externalidades aeroportuarias, gestión de ciudades, transporte

Introduction

The analysis of the economic impact of airports tends to be carried out under great scrutiny from public opinion, as this can establish a parallel of cause and effect between the airport and its environmental impact (Montalvo, 1998). The airline industry across the globe generates a large number of economic activities that influence employment and economic growth. Dhakal *et al.* (2020) highlight the fact that the negative effects of the airline industry are perceived but lose ground in terms of urgency to the need to seek efficiency in this sector. Babashamsi *et al*. (2016) consider that the breadth of the term sustainability means that it is becoming increasingly common for organisations to develop their own definitions and use their own methodologies to approach the term in question.

The complexity of the competition in the airport industry is perceived in three aspects: competition between airport groups, competition between airports in the same customer catchment area and competition due to the wide range of airport services (Gitto & Mancuso, 2019). To this is added the fact that the airport is being converted into a commercial center, which in turn is a catalyst for local economic development. Although the world is evolving towards the end of the importance of geographical distance, it is still very important when it comes to connecting remote countries located on four continents (Lenaerts *et al.,* 2021). The transport of people and goods worldwide is only possible with the contribution from the airline industry, as it can carry out this action in a short period of time.

The assessment of the importance of airports is based on two assumptions: the benefits of transport and the economic impact. The first assumption covers time savings, cost evasion, transport safety and, in turn, the other assumption covers the direct (based on accounting information), indirect and induced (assumption in gathering information) components (Montalvo,

1998). This work aims to study the perception of the socioeconomic and environmental impacts of the Huambo Airport, in this Angolan city and province. To achieve this objective, in addition to this introduction section, a literature review is carried out, where items related to the economic and social impact of an airport, the importance of politics and urban planning in city management, and the positive and negative impacts of the airport are presented. Subsequently, the methodology is presented, followed by the analysis and discussion of the results, presenting descriptive statistics and an exploratory factor analysis of perceptions about the impact of the airport. The last point presents the main conclusions and policy recommendations to be followed by official entities.

Literature Review

The economic and social impact of an airport

The impact of infrastructure on economic growth must be observed as a whole of the two elements presented in private and public form. The infrastructure of a country is a collection made up of durable assets that are useful for public use (Ortiz, Restrepo & Cruz, 2019). Lenaerts, Allroggen and Malina (2021) highlight that access to the market is more easily guaranteed by the participation of the airline industry, within the framework of a globalized world. The good functioning of the airline industry means that the companies present there begin to compete with new competitors, and both make a great contribution to the growth of tourism, and the increase in cargo transport by air and logistics (Florido-Benítez, 2021).

Tang, Wang and Wang (2021) believe that regional development is currently linked to the airport economy. When there is an improvement in the connection between the airport infrastructure and the region, coordinated regional growth is more easily promoted. Also, Fu *et al*. (2021) highlight that the influence that the aviation system provides on economic activity in the region is positive, as it develops the local economy. In turn, the effects of regional economic development affect both the airport and the metropolitan area, through population and employment growth (Fu *et al*., 2021).

Galeote and Mestanza (2020) also highlight that the analysis of the airport's impact is best understood in the field of qualitative assessment, analysing the perception that tourists and residents present. This is because tourist activity is one of the largest growing in the world but, although it is not the one that employs the most, it is, however, one of the activities that most involves consumers. It is undeniable that tourism and air transport have close relationships and, when perceived, can influence the economic growth of a location, region or even a country (Galeote & Mestanza, 2020).

For Skouloudis, Evangelinos and Moraitis (2012), the airline industry has seen a change in attitude, with an ever-increasing number of non-financial reports aimed at disclosing actions geared towards the industry's social responsibility. The airport, as part of the airline industry, brings regional development to the community and, at simultaneously, introduces noise into the environment, which is caused by aircraft. This double effect caused by the airline industry is recognized by the community, and it often demands an end to the negative influence of noise from planes that operate there (Dhakal *et al.,* 2020).

Brand perception is vital for the survival of an institution, and this characteristic must also be present in an airport (Gitto & Mancuso, 2019). The scenario of instability that affected companies in the airline industry extended throughout the global economy, demonstrating the influence that the airline industry has on the stability in the development of most countries (Hao & Xuan, 2020). The airline industry has been playing a facilitating role in mobility and economic growth, especially in the context marked by the COVID-19 crisis. It is the airline industry that is most useful for consumers to be able to return to their countries, to their activities and has also allowed the transport of medical equipment (Galeote & Mestanza, 2020; Santos *et al*., 2020).

Aligning investment criteria in the area of airport infrastructure makes it possible to take into account the need for interconnection with one of the transport models, of which railways and highways are particularly prominent (Montalvo, 1998; Relógio, Tavares & Pacheco, 2017). A country's infrastructure is a basic component for economic development. Ortiz *et al.* (2019)

warn that infrastructure alone is not enough to achieve economic development because this includes, in addition to infrastructure, the contribution of agents, including business people, workers and the State. Lee *et al*. (2021) consider that the effort carried out by government authorities, based on a persistent alert, for the creation of new airport infrastructure, aims to grant new and greater route options in order to overcome the lack of options in land connections with other countries.

The leap in growth that the connection between the airport economy and regional development provides constitutes a way for government authorities to pay more attention, in terms of investment, to public resources in the economic zones linked to the airport and a region (Tang *et al*., 2021). The introduction of practices based on the planning and development of sustainable airport infrastructures are felt by society as benefits in financial and operational terms, and in reducing the negative impact on the environment (Chourasia *et al*., 2021). Sustainability goes beyond concern for the environment, given that, when sustainable development occurs in a location, it is understood that it encompasses the economic-social and environmental components.

Therefore, in terms of economic and social impact, it is expected that an airport, in this globalized world, in addition to participating in the airline industry, will contribute to the growth of tourism, cargo transport and coordinated regional growth. An airport structure brings development to the regional community, playing a facilitating role in mobility, through interconnection with other transport models such as railways and highways. It is essential to introduce sustainable management practices to reduce the negative impact on the environment, and achieve economic and social development based on sustainability.

Politics and urban planning in city management

The birth of an airport structure gives rise to many other events in the space surrounding the Airport (Branco, 2013). Accessibility constitutes a challenge for the airport administrator because he has no control over the access roads to the airport. The lack of capacity to control

road transport constitutes a condition for the administrator to promote increasing productivity (Caldas, 2008). Caldas (2008) and Branco (2013) see urban intervention in airports as a challenge to planning, due to the accelerated and disorderly growth that cities pass through, with the fragility of control instruments and land use planning.

Failure to comply with urban policy instruments can cause cases of crystallization in city management, with environmentally perverse effects such as the precariousness of services that degenerate into urban disorder and social conflicts (Caldas, 2008). When granting infrastructure, the range of transport modes should not be neglected, especially road and rail; and depending on natural conditions, water transport may be integrated (Mamede & Alves, 2009; Relógio, Tavares & Pacheco, 2017).

The relationship between the city's infrastructure and the airport can be seen from its design, where it aligns with the city's proximity, influencing it and receiving influence from it (Gomes & Bayer, 2011). When planning the cohabitation of the airport with the city, thinking should not be confined to the city, but should encompass the perspective of industry (Branco, 2013). Costa (2013) considers that living areas can take on different urban dimensions and depend on the pressure of the rural exodus phenomenon, based on the move from the countryside to the city. The pressure that demand exerts on the air transport industry is responsible for the process of reforming airport infrastructures. Fu *et al*. (2021) consider that the influence that airport infrastructure produces on regional economic development should not be understood only in terms of large airports, as small airports also contribute to this purpose. For the sustainable development of a city, it is necessary to adapt the relationship between airport master plans and urbanization plans (Galeote and Mestanza, 2020).

The impact of the airline industry, to remain present, requires the cities under its influence to preserve ease of access to airport infrastructure (Lenaerts *et al*., 2021). Babashamsi *et al*. (2016) consider that sustainable business management has gained preponderance in general; and for the field of airport infrastructures this reality is also evident,

especially with regard to the sustainability of the airport pavement. Hakfoort and Rietveld (2001) highlight that the airport can function as a valid transport node for demand, and must adapt in terms of dimensions, employment characteristics and population located close to the airport infrastructure.

Mamede and Alves (2009) highlight that the airport can reduce its dependence on road transport if it decides to integrate other modes of transport such as rail and water. When an airport structure is created, and despite the fact that it is located far from the city, as well as from the direct influence of the population and occupies a vast space, sooner or later it is affected by the action of both (Branco, 2013).

In Africa, urban growth is characterized as concentrated around a location that assumes the role of the capital city, and it is there that we see the most accelerated development, as an urban nucleus (Costa, 2013). Monterrubio *et al*. (2020) consider that the population being displaced almost always perceives the impact of airport infrastructure constructions from a different perspective, from the perspective of government authorities.

In urban planning policy in city management, accessibility is a challenging element to maintain sustainability. Road transport is a constraint but the airport can and should reduce its dependence on road transport by integrating other modes, such as rail and water. In urban planning, city and airport infrastructure must coexist, where thinking must encompass the perspective of sustainable development, requiring adaptation in the relationship between airport plans and city urbanization plans.

Negative impacts of the airport

Analysing the negative impacts on the airport area's environment makes it possible to choose the best airport procedures and programmes to adopt in the pursuit of sustainable development. Among the negative impacts, the effects of noise pollution from engine noise, soil degradation caused by their fluids stand out, and when mixed with rainwater, they are carried into rivers, lakes and lagoons (Henkes & Pádua, 2017). The commercial area of airports is the

place where, in addition to aircraft, land vehicles such as passenger buses, tanker trucks and aircraft towing tractors operate, which have the particularity of being powered by diesel engines (Helber et al., 2018). Souza and Bueno (2011) and Pacheco, Lote and Tavares (2017) understand that land occupation with urbanisation caused by an airport puts greater pressure on the rural area of influence, and reduces the space for growing food for consumption by the people who live there.

Helber *et al*. (2018) propose a solution for airports to reduce the negative impact on the environment, and the use of electric vehicles in the airport space in which they operate. The development of efforts to satisfy the high demand for flights has not only contributed to the transformation of the airport system, but is also attracting more and more residential activity and with it greater risks of the effects of noise and air pollution (Hudda *et al*., 2020). The negative effects caused by the operational activity of the airport system are felt by the population surrounding the airport, with increasing rates of health deterioration, which include hypertension, cardiovascular disorders, respiratory diseases, learning deficits in children, and even birth results (Hudda *et al*., 2020).

Monterrubio, Andriotis and Rodríguez-Muñoz (2020) highlight residents' perceptions of the impact of airport construction, which are often dominated by a marked sceptical bias. The negative influence that the airline industry passes onto society is felt in different ways, including the emission of noise by aircraft during the take-off and landing process, the creation of waste and energy consumption (Chourasia *et al*., 2021).

The negative impacts of the airport include pollution caused by noise and soil degradation caused by engine fluids when mixed with rainwater. The construction and expansion of airports also causes some pressure on the surrounding areas, which is why planning is important to avoid future problems.

Positive impacts of the airport

Companies and airports nowadays don't just look at profit as their sole objective, as the issue of sustainability has been brought into the spotlight by being taken into the organisational sphere and reflected directly there. Henkes and Pádua (2017), highlight that faced with this reality, a new stance was taken, as they began to worry more about balancing the needs of workers and environmental demand, where one of the aspirations is a greater quality of life for the man and the preservation of nature. Sheard (2019) considers that airports have a positive effect on economic growth in the regions they serve. It is clear that the region that houses the airport benefits the employed population in terms of increased productivity, improved wages and convenience (Sheard, 2019).

The ideal use of airport infrastructure and the investment captured for the long term end up being seen as benefits, and are desired by governments and regulators, to then achieve public well-being (Relógio & Tavares, 2023; Voltes-Dorta & Lei, 2013). The panorama that commercial aviation has created guarantees the airline industry results that go beyond this, by having a positive impact on countries' economies, especially when it allows for the generation of employment, income and is at the origin of the dynamic flow of international tourism (Henkes & Pádua, 2017). Poll (2017) understands that in the field of air transport, civil aviation appears as the support base for the characterization of world trade.

Luke and Walters (2010) consider that in a situation of stability, airports begin to play a catalytic role in generating employment in the economy because they are capable of enabling wealth creation. Button and Yuan (2010) highlight that within the scope of the new perception linked to regional development, new growth theories stand out that validate information on economic development.

Halpern and Bråthen (2011) point out that the emphasis on air transport (in Norway) is largely due to the country's topography and climate. Improving the mobility of people and goods is facilitated by the contribution made by air transport, which facilitates and guarantees

economic and social cohesion between countries, regions and localities (Martín-Cejas, 2021; Relógio & Tavares, 2023). The impact of the airline industry on a location allows it to become more easily accessible, thereby introducing a trend towards lower living costs and making it more attractive for economic agents to set up shop (Lenaerts at al., 2021).

By attracting investment for a region, an airport infrastructure brings with it benefits desired by governments and populations, as the aim is public well-being. The aviation panorama has brought with it a positive impact on the countries' economies, through the creation of jobs and the dynamics of international tourism; and is also a basis for sustaining international trade. The positive impact of the airline industry allows for the creation of other industries, and a tendency to reduce the cost of living and increase the attractiveness for creating wealth.

Methodology

To study the perception of the impacts of Huambo airport, in the Huambo city and province, a survey was carried out. The survey was distributed to residents of the city of Huambo, and to people who work near the airport, to be filled out. Firstly, a set of questions were asked about the demographic profile of those surveyed and their perception of the economic and social impact of Huambo Airport, in Angola. And the second part comprises a set of questions that result from the literature review, about the positive and negative impacts of an airport. To evaluate the perception of the inhabitants of the city of Huambo, a 5-point Likert scale was used (1 - Totally disagree to 5 - Totally agree).

The final version of the questionnaire was pre-tested with 60 surveys. After making small adjustments, the questionnaires were distributed for self-completion, obtaining a non-probabilistic sample, consisting of 669 individuals. The data resulting from the administration of the questionnaire was processed using the IBM SPSS Statistics computer programme.

The questionnaires were distributed for self-completion in person. The non-probabilistic convenience sample initially consisted of 700 individuals. 669 were validated, aged between 18

and 78, as 31 presented irregularities when filling out the questionnaire. Fieldwork was carried out in July, August and September 2022. Completing the questionnaire took 15 to 20 minutes. To study the survey, Exploratory Factor Analysis is used. In the opinion of Hair *et al.* (2005), Factor Analysis is a set of multivariate statistical techniques that analyze the patterns of complex relationships simultaneously, in order to define the structure underlying a set of variables. Exploratory Factor Analysis was used to extract the preponderant factors in choosing Huambo Airport. Pestana and Gageiro (2014) and Marôco (2018) understand that it is an exploratory analysis technique that aims to discover and analyse a set of interrelated variables in order to constitute a measurement scale for factors that in some way control the original variables. The variables intended for multivariate analysis come from questions, obtained through answers on a Likert scale from 1 to 5.

Taking into account that in the Kaiser-Meyer-Olkin (KMO) test, according to Pestana and Gageiro (2014),]0.9 – 1.0] = Excellent;]0.8 – 0.9] = Great;]0.7 – 0.8] = Good;]0.6 –0.7] = Regular;]0.5 – 0.6] = Mediocre; KMO<=0.5 = Inadequate, use the Bartlett test to see its level of significance, if it is 0.000, we reject the hypothesis that the correlation matrix in the population is the identity matrix. Cronbach's Alpha values, according to George and Mallery (2003), have the following interpretation:]0.9 – 1.0] = Excellent;]0.8 –0.9] = Good;]0.7 –0.8] = Acceptable;]0.6 – 0.7] = Doubtful;]0.5 –0.6] = Poor; <=0.5 = Unacceptable.

According to Marôco (2018) and Pestana and Gageiro (2014), the t-Student test is also used to test whether or not the means of two populations are statistically different. This test requires that the two samples have been randomly obtained from two populations, and that the dependent variables have a normal distribution and homogeneous variances. In studying the empirical part of the survey, we intend to verify whether there are differences in the responses between males and females that are statistically significant at the 5% significance level. That is, we intend to test whether H0: $\mu 1 = \mu 2$ vs. H1: $\mu 1 \neq \mu 2$. The t-Student test was applied to test these hypotheses.

Analysis and discussion of results

Descriptive analysis of the results of the population residing in the city of Huambo

The descriptive analysis of the results linked to Huambo Airport aims to determine the degree of negative and positive influence that the Airport exerts on the Central Plateau region of Angola. As mentioned, the sample under study is made up of 669 individuals aged between 18 and 78 years old and has an average age of 30 years ($\bar{x}$= 30,80). Regarding gender, it is observed that 47.4% are male and 52.6% are female. Regarding the respondents' nationality, there is a predominance of Angolans with 97.2% and other nationalities represented 2.8%. Regarding marital status, it is observed that singles appear in the majority with 60.7%, followed by married or cohabiting couples with 33.0%, while for separated or divorced the representation is 3.6%, and for widowers 2.7%.

Regarding the level of education, the Secondary level of studies stands out with 54.4%, followed by the bachelor's degree with 21.1%, while the 9th grade comes with 20.6%, completed with the master's degree and the PhD with 3.9%. Regarding the size of the household, in the sample of 669 individuals, the composition varies between 2 and 21 members, and amounts to an average of 6 individuals ($\bar{x}$= 6,67%). About the type of residence, the house appears with 81.8%, followed by the apartment with 18.2%. In turn, the distance in kilometers from the airport between 5 and 10 km is the value for 41.9% of respondents, followed by 30.5% for more than 10 km, 2 to 5 Km with 21.4%, completed with those less than 2 km with 6.3%. Table 1 shows the degree of perception regarding the proximity of Huambo Airport.

Table 1

Degree of perception regarding the existence of proximity to Huambo Airport

	Average	Median	Trend	Standard Deviation	Totally Disagree	Disagree	Undecisive	Agree	Totally Agree
Land prices are higher near the Airport.	3,58	4	4	1,011	4,6	15,1	7,5	62,9	9,9
Housing prices are higher near the Airport.	3,53	4	4	0,99	3	18,7	9,6	59,9	8,8
There are more road accidents on the roads near the Airport.	2,48	2	2	1,079	12,9	54,7	8,1	20,2	4,2
There is noise in the urban area next to the Airport.	2,39	2	2	1,071	13,5	59,9	7,8	12,3	6,6
There is noise pollution caused by the noise from aircraft engines.	2,10	2	2	0,926	24,1	53,8	13,2	6,3	2,7
There is residue from the activity of vehicles operating in airport facilities.	2,10	2	2	0,801	20,2	56,7	17,2	5,2	0,7
There is pollution caused by passenger buses, tanker trucks and towing tractors.	2,10	2	2	0,871	18,1	66,4	5,7	7,2	2,7
There is soil degradation caused by fluids, during the rainy season, on the land next to the Airport.	2,05	2	2	0,76	20,8	58,1	16,4	4,2	0,4
The air near the Airport feels more polluted.	2,00	2	2	0,726	19,6	66,8	8,4	4,5	0,7
Traffic near the Airport is very congested.	1,99	2	2	0,817	24,4	60,1	9,9	3,7	1,9
There is a negative environmental impact caused by the airport.	1,95	2	2	0,754	25,1	59,2	11,8	3,0	0,9
There is a lot of trash on the streets near the Airport.	1,75	2	2	0,752	37,8	54,6	3,6	3,0	1,0

Source: Elaborated by the author

The items with the highest averages are the result of the perception of respondents who agree with these items. In view of this, the fact that land and housing prices are higher near the Airport stands out with the higher averages. These two items have average values greater than three on a five-level Likert scale. Items with this level of perception highlight the importance of

living close to Huambo Airport. The items with the lowest degree of perception when measured by respondents were the existence of a lot of rubbish on the streets near the Airport, the existence of a negative environmental impact caused by the Airport and the fact that traffic near the Airport is very congested. Items with this level of perception made it possible to highlight the non-existence of negative aspects linked to the environment and mobility.

Table 2 shows the results of the perception of development in the vicinity of Huambo Airport. The items with higher averages are those linked to the fact that Huambo Airport is important for regional mobility and development, Huambo Airport has a great impact on improving the attractiveness of the region; as well as, in general, Huambo Airport having a positive economic and social impact on this province.

Table 2

Degree of perception regarding development due to the proximity of Huambo Airport

	Average	Median	Trend	Standard Deviation	Totally Disagree	Disagree	Undecisive	Agree	Totally Agree
Huambo Airport is important for mobility and regional development.	4,09	4	4	0,694	1,6	1,8	4,6	69,7	22,3
Huambo Airport has a great impact on improving the attractiveness of the region.	4,04	4	4	0,715	1,3	2,7	7,5	67,6	20,9
In general, Huambo Airport has a positive economic and social impact on this province.	4,00	4	4	0,619	1,0	2,4	5,5	77,3	13,8
The Huambo Airport area is attractive.	3,99	4	4	0,642	1,5	2,8	3,6	79,4	12,7
There is concern about preserving nature near the Airport.	3,96	4	4	0,722	1,8	2,8	8,7	70,7	16,0
The Airport allows greater accessibility to Huambo.	3,96	4	4	0,793	1,6	4,8	9,4	64,6	19,6
There is concern about maintaining the environmental balance in the Airport region.	3,87	4	4	0,804	2,2	3,3	16,1	61,6	16,7
The Huambo Airport area is well lit.	3,83	4	4	0,811	0,7	6,7	17,9	57,7	16,9
It is felt that the Airport improves the quality of life of the people of Huambo.	3,81	4	4	0,802	3,3	4,0	11,7	70,6	10,5
The Airport allows the local economy to be boosted.	3,80	4	4	0,713	2,2	3,9	12,4	74,7	6,7
The Airport allows local tourism to be boosted.	3,80	4	4	0,768	2,2	4,5	14,6	68,5	10,2
Huambo Airport boosts the local economy.	3,78	4	4	0,730	2,4	4,9	10,8	75,9	6,0
Huambo Airport greatly increases local work options.	3,78	4	4	0,727	2,2	4,5	13,0	73,7	6,6
The Airport has a positive economic effect on Huambo province.	3,77	4	4	0,920	1,9	7,6	21,5	48,9	20,0
The Airport has a positive economic effect on the city of Huambo.	3,74	4	4	0,934	1,9	7,5	26,2	43,9	20,5

Continues on the next page

There have been investments in infrastructure near the Airport.	3,71	4	4	0,865	2,5	6,6	20,9	57,1	12,9
The Airport allows local labour to be employed.	3,66	4	4	0,767	2,1	5,1	24,7	61,4	6,7
The Airport promotes new (and different) jobs.	3,63	4	4	0,985	4,3	11,5	13,6	58,3	12,3
The Airport allows local employment to grow.	3,59	4	4	0,773	2,1	7,5	23,3	63,1	4,0
Huambo Airport is well located.	3,58	4	4	1,270	11,4	13,6	1,2	53,2	20,6
There is a tourist dynamic promoted by the Airport.	3,46	4	4	0,851	2,5	9,0	35,7	45,6	7,2
There is a business dynamic promoted by the Airport.	3,43	3	4	0,828	2,4	8,2	39,9	42,9	6,6
There is promotion of local employment by the Airport.	3,41	4	4	0,962	6,0	10,8	24,8	53,1	5,4
The area next to the airport is the safest area in the city.	3,14	4	4	1,142	12,9	16,1	19,4	47,2	4,3
The jobs created by the Airport are paid above average.	2,96	3	2	1,047	6,0	33,6	24,1	31,1	5,2
Public investments in infrastructure (roads, water, sanitation, etc.) are greater in the vicinity of the Airport.	2,87	3	4	1,142	14,1	28,1	17,3	38,1	2,4

Source: Elaborated by the author

These items have an average of around four on the five-level Likert scale. In turn, the items with the lowest average are those related to the jobs generated by the Airport being paid above average, as well as public investments in infrastructure (roads, water, sanitation, etc.) being in greater numbers in the vicinity of the Airport.

Exploratory Factor Analysis of the perception of proximity to the Airport

Factor Analysis presupposes the existence of a smaller number of unobservable variables underlying the data that express what the initial variables have in common.

To conclude whether the Factor Analysis is adequate, we calculate the KMO statistic and perform the Bartlett test. Taking into account the KMO value (0.803), which according to

Pestana and Gageiro (2014) and Marôco (2018) allows for an optimal Factor Analysis and since the Bartlett's test is associated with a significance level of 0.000, it leads us to reject the hypothesis that the correlation matrix in the population is the identity matrix, thus showing that the correlation between some variables is statistically significant. Given these two results, we can conclude that Factor Analysis is appropriate for the items related to proximity to Huambo Airport.

Once the correlation between the variables in both previous tests has been verified, we can proceed with the Factor Analysis. Table 3 refers to the extraction of six factors. We also see in Table 3 that the eigenvalues of the six factors are all greater than 1 (Kaiser criterion). Several attempts were made to ensure that the loading of each variable was greater than 0.5; that is, variables with loadings lower than 0.5 were successively removed (Table 4).

Factor Analysis resulted in the extraction of six factors responsible for 59.055% of the total variance (Table 3). The unexplained variance, of 40.945%, may be related to other less relevant factors, resulting from other combinations of variables.

Table 3

Total variance explained in perception regarding proximity to Huambo Airport

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	% cumulative	Total	% of variance	% cumulative	Total	% of variance	% cumulative
1	4,795	22,833	22,833	4,795	22,833	22,833	3,296	15,696	15,696
2	2,541	12,100	34,933	2,541	12,100	34,933	2,391	11,385	27,081
3	1,610	7,665	42,598	1,610	7,665	42,598	1,930	9,193	36,274
4	1,239	5,898	48,496	1,239	5,898	48,496	1,687	8,033	44,306
5	1,193	5,681	54,178	1,193	5,681	54,178	1,554	7,398	51,704
6	1,024	4,877	59,055	1,024	4,877	59,055	1,544	7,351	59,055

Extraction Method: Principal Component analysis

In Table 4, the factors selected from the analysis of the main components are designated and interpreted. Regarding factor 1, the observation of the variables that contribute to explaining this factor allows us to conclude that we are dealing with aspects linked to the economic growth allowed by the Airport. Thus, this factor is explained by the importance people attach to the fact that the airport allows local employment to grow, allows local labour to be employed, allows the local economy to be boosted, allows local tourism to be boosted, there is a business dynamic promoted by the airport, and the items show good consistency. In factor 2, the observation of the variables that contribute to characterizing the negative externalities in the vicinity of the airport. Thus, this factor is explained if there is a negative environmental impact, there is a lot of trash in the nearby streets, the air near the Airport feels more polluted, the traffic in the vicinity is very congested, there is pollution caused by passenger buses, tanker trucks and towing tractors, and this factor presents an acceptable consistency.

Table 4

Matrix of rotating components resulting from the perception of the proximity of Huambo Airport

	Component						
	1	2	3	4	5	6	
The Airport allows local employment to grow.	,781	,107	,056	,059	,007	,140	Impact and economic growth enabled by the airport
The Airport allows local labour to be employed.	,729	-,078	-,021	,195	-,119	,089	
The Airport allows the local economy to be boosted.	,710	-,143	-,226	,097	,078	,064	
Huambo Airport boosts the local economy.	,631	-,129	-,105	,039	,261	,063	
The Airport allows local tourism to be boosted.	,614	,027	-,268	-,036	,136	,091	
There is a business dynamic promoted by the Airport.	,546	-,014	,255	-,114	,242	,171	
There is a tourist dynamic promoted by the Airport.	,546	-,175	,286	,096	,269	,032	
There is a negative environmental impact caused by the airport.	-,042	,717	,156	-,058	-,114	-,184	Negative externalities in the vicinity of the airport
There is a lot of trash on the streets near the Airport.	,089	,685	-,154	,087	-,130	,027	
The air near the Airport feels more polluted.	-,077	,639	,282	-,031	-,011	,127	
Traffic near the Airport is very congested.	-,064	,611	,192	-,030	-,134	-,140	
There is pollution caused by passenger buses, tanker trucks and towing tractors.	-,172	,610	,240	-,051	,081	,007	
There is residue from the activity of vehicles operating in airport facilities.	-,110	,237	,690	-,085	,007	-,072	Pollution at the airport
There is noise pollution caused by the noise from aircraft engines.	,076	,124	,651	,037	-,242	,011	

There is soil degradation caused by fluids, during the rainy season, on the land next to the Airport.	-,085	,217	,619	-,122	,002	-,130	
Land prices are higher near the Airport.	,086	-,073	,058	,896	,076	,068	Real estate appreciation near the airport
Housing prices are higher near the Airport.	,119	,033	-,226	,852	,096	,092	
There is promotion of local employment by the Airport.	,156	-,126	-,024	,100	,795	,100	Promotion of employment by the airport
The Airport promotes new (and different) jobs.	,237	-,105	-,196	,078	,724	,117	
There is concern about preserving nature near the Airport.	,173	-,124	,007	,037	,082	,865	Concern for nature preservation near the airport
There is concern about maintaining the environmental balance in the Airport region.	,270	,007	-,219	,162	,160	,769	
Cronbach's Alpha	,800	,706	,600	,768	,643	,708	

Source: Elaborated by the author

Factor 3 presents the variables related to pollution at the airport. Thus, this factor is explained if there is residue from the activity of vehicles operating in airport facilities, there is noise pollution caused by the noise of aircraft engines and there is soil degradation caused by fluids, during the rainy season, and in nearby land. This factor has doubtful consistency.

In factor 4, we can observe the variables that contribute to the appreciation of real estate near the Airport. Thus, this factor is explained by the higher land prices close to the Airport, as well as the price of housing, and this factor has an acceptable consistency.

In factor 5, we observe the variables that contribute to the promotion of employment by the Airport. Thus, this factor is explained if there is promotion of local employment and promotion of new (and different) jobs, and this factor presents a doubtful consistency.

Factor 6 shows the variables that contribute to characterising the concern for nature conservation at the airport. Thus, this factor is explained by the concern that exists in preserving nature and the concern with maintaining the environmental balance in the region. This factor presents an acceptable consistency.

Statistically significant difference in averages related to the Airport

Table 5 presents the statistically significant average differences of the various survey items related to the Airport, in terms of gender difference. As can be seen, there is a set of items where the differences are statistically significant, and in all these items, the highest averages are presented by males, with the exception of the last item - Huambo Airport greatly increases the options for local work – where the average is higher for women.

Table 5

t-test for difference in averages: gender – items related to Airport

	Levene's test for equality of variances (do we accept H0?)				t-test for equality of average
	t-test	(*p-value*)	Male	Female	t-test (*p-value*)
There is noise pollution caused by the noise from aircraft engines.	2,113	0,000	2,18	2,03	0,035
There is residue from the activity of vehicles operating in airport facilities.	2,739	0,000	2,19	2,02	0,006
There are more road accidents on the roads near the Airport.	2,190	0,004	2,58	2,39	0,029
There is noise in the urban area next to the Airport.	2,742	0,000	2,50	2,28	0,006
There is pollution caused by passenger buses, tanker trucks and towing tractors.	2,253	0,002	2,18	2,03	0,025
The air near the Airport feels more polluted.	2,451	0,057	2,07	1,93	0,015
Huambo Airport greatly increases local work options.	-2,337	0,001	3,71	3,84	0,020

Equality of variances/averages: *p<0,05; **p<0,01 and ***p<0,001.
Source: Elaborated by the author

Discussion of results

The population surveyed and residing in the city of Huambo has an average age of 30 years, the majority of whom have completed the Secondary level of studies. Residents in the city's perimeter are mostly single, belonging to a household that, on average, consists of six individuals. The residences that house most of the city's inhabitants are villas and on average they are five to ten kilometres from the airport. From the survey results, we can see that there is a perception that in the vicinity of the Airport the value of land is higher, and the price of housing

is more expensive. On the other hand, this type of infrastructure is important for mobility and regional development, and further improves the attractiveness of Huambo province (according to Lenaerts *et al*., 2021) and its economic and social level. These are in accordance with what was mentioned in the literature review, namely by the authors Fu *et al*. (2021) and Galeote and Mestanza (2020).

On the other hand, from the results obtained we can observe that people have a positive perception about the possibilities of improving local employment, improving the quality of life, creating opportunities for tourism and the creation of other local development infrastructures. These results are in line with Dhakal *et al*. (2020); Hao and Xuan (2020); Ortiz *et al*. (2019); and Tang *et al*. (2021).

From the Exploratory Factor Analysis, six factors emerge resulting from perceptions about the socioeconomic impacts of Huambo Airport. Positive factors include the impact and economic growth allowed by this structure. This result is in line with Sheard (2019); Fu *et al*. (2021); Galeote and Mestanza (2020). Other positive factors are the appreciation of real estate in areas close to the Airport (according to Tang *et al.,* 2021); promoting local employment (according to Dhakal *et al*., 2020; Fu *et al*., 2021; Hakfoort and Rietveld, 2001); and the perception that there is a concern with the preservation of nature nearby, which is also in line with Henkes and Pádua (2017).

As aspects of perception and concern, those linked to the pollution caused and other negative externalities. Although they appear as factors of concern in general, negative externalities themselves do not exist, as it is a well-maintained area of the city, as can be proven by the answers given and presented in Table 1. As can be seen from the results presented, people do not agree with the statement that there is a lot of trash in the neighbourhood, nor that there is a negative environmental impact, nor that there is soil degradation or traffic congestion.

In the statistically significant average differences, we see that in the aspects related to pollution (noise and air), the male gender is less tolerant and shows statistically significant average differences with higher averages. On the other hand, females have a higher and statistically significant average as they understand that the airport greatly increases local work options.

Conclusion and recommendations

This defined the objective of studying the perception of the socioeconomic and environmental impacts of Huambo Airport, in this city and Angolan province. The survey for the present study was carried out during a period in which the negative effects of the Covid-19 pandemic were reversed and, as such, it coincided with the resumption of socioeconomic activity in Angola. The results of the survey prove that the airline industry provides good services that are perceived as improving the quality of life for the population residing in the Central Plateau region, in Angola.

Concerning the respondents' perception of the existence of an economic and social impact of Huambo Airport in the neighbourhood, the opinions are in agreement that there is such an impact in the area close to the airport. This is justified by the fact that proximity promotes development, a situation that can be seen in the items linked to the existence of concern for maintaining the environmental balance in the region, and concern for the preservation of nature, as well as being a structure that allows local labour to be employed, and an element that has a positive impact on the province and on the economic and social framework.

It is concluded that there are six factors that demonstrate the impact of Huambo Airport: the impact and economic growth allowed by the airport; the negative externalities near the airport; pollution at the airport; real estate appreciation near the airport; the promotion of employment by the airport; and the concern with preserving nature near the airport.

The survey also addressed the analysis of statistically significant differences in averages related to the Airport, at gender level. It can be concluded that the highest averages are presented by males, except for the last item (Huambo Airport greatly increases local work options), in which females register the highest average. This shows that men are the ones who have the most contact with the items, when compared to women. Some of these items include those linked to the existence of noise pollution caused by the noise of aircraft engines, the existence of waste from the activity of vehicles operating in airport facilities, the existence of more road accidents on the roads near the Airport, the existence of a lot of noise in the urban area near the airport, the existence of pollution caused by passenger buses, tanker trucks and towing tractors, as well as the air near Huambo Airport feeling more polluted.

The results obtained in this work are important for management and public administration, as they allow us to understand the perceptions of the impact of positive and negative variables on the management and urban environment of an airport. Official entities must promote integrated and coordinated planning policies, with the involvement of different bodies linked to the transport, infrastructure, environment and tourism sectors. Encourage the participation of the community affected by the Huambo Air Terminal in the decisions discussed.

As a limitation to this study, there are few studies on this area of knowledge in Angola, as well as a limited review of the literature that characterizes the airport industry. Targeting the study to the Central Plateau region of Angola, which circumscribes the central interior of the country.

As future work in this area of knowledge, it will be important to study whether there is a homogeneous or heterogeneous perception of the impacts of the airport, by people who live in a location further away from the airport. It will also be possible to study which economic sectors have the greatest impact of this airport structure.

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