HUMAN RESOURCE STRATEGIES FOR BAGGAGE HANDLING EXCELLENCE.A
COMPARATIVE STUDY OF IN-HOUSE AND THIRD-PARTY PRACTICES.
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Abstract

Baggage handling is crucial in aviation operations, significantly impacting airlines' efficiency and customer satisfaction. Ineffective practices can result in financial losses, customer discontentment, and potential airline fines. This study reviews relevant literature and aligns findings with the Key Performance Indicators (KPIs) employing distinct baggage handling types (Organic vs. Third-party). Examining efficiency, process quality, and customer satisfaction's KPIs to unveil the benefits and drawbacks of organic and outsourced baggage handling. Through the analysis of mishandled, lost, and damaged baggage metrics, the research identifies similarities and dissimilarities, assisting airlines in decision-making based on their business models. The study of these indicators yields insights that guide airlines in making reasonable choices concerning their baggage handling strategies. The project aspires to trigger future investigations and promote the development of optimal practices in the commercial aviation industry, aiming to enhance overall efficiency and customer satisfaction in baggage handling operations.

Keywords: baggage handling, ground handling efficiency, KPI, organic, third-party

Introduction

Since the deregulation in the 1970s, the aviation industry has experienced exponential growth. Despite this remarkable progress, airlines continue to face challenges in delivering exceptional service quality to passengers. Baggage handling is among the essential aspects affecting efficiency and customer satisfaction. According to ANAC Consumer Monitoring Report - 1st quarter of 2023 (ANAC, 2023), complaint about baggage is around 11.8% of all complaints registered. Ineffective practices in this domain can lead to financial losses, customer discontent, and potential legal liabilities.

To address these challenges, a comprehensive analysis of baggage handling processes and adherence to international and national aviation regulations, like the Montreal Convention and ANAC's RESOLUTION Nº. 400 is imperative. The Montreal Convention, a significant international treaty adopted in 1999, provides a unified framework for airline liability for accidents, injuries, and damages during international air travel. Supported by RESOLUTION Nº 400 of December 13, 2016, issued by ANAC, the Convention and ANAC set out guidelines for ratification and enforcement.

This research explores the complexities of baggage handling within the context of one of the major Brazilian airlines. The airline employs distinct baggage handling staff types, adopting in-house (organic) and third-party (outsourcing) approaches. The focus of this research is on aligning findings with key performance indicators (KPIs) governing baggage handling efficiency, process quality, and customer relationships. Industry standards and regulatory requirements will identify the KPIs, serving as metrics for analyzing baggage handling operations.

Problem Statement

Baggage handling is a critical issue in the aviation industry, impacting efficiency and the passenger experience. In 2022, more than 4 million bags were mishandled during transfer, costing the industry $2.2 billion (Tackling the Airport Baggage Handling Problem, 2023). The prevalence of baggage complaints underscores the urgency of addressing this issue.

A Gartner study highlights the significant impact of baggage handling issues on customer perception in the service industry. The report states that 53% of customers correlated their baggage experience with their overall impression of a company (Blum, 2018). When passengers encounter baggage-related issues, it directly impacts their perception of the airline. This causes frustration and inconvenience that can outweigh an otherwise positive experience and impact customer loyalty. Therefore, the financial and brand values highlight the pivotal role that effective baggage handling plays in reducing operational costs and shaping customer perceptions.

Research Questions

This study seeks to answer the following research questions:

- What are the main differences and relationships between in-house and outsourced ground-handling solutions?

- What areas of improvement can contribute to increasing baggage handling performance?

- How can effective human capital management reduce baggage issues and improve customer satisfaction?

Limitations

The study recognizes the limitations of focusing on a single Brazilian airline for comparing organic and outsourced baggage handling methods. Other regions and markets worldwide may have different perspectives. Technology, infrastructure, and lack of specialized personnel can influence baggage handling dynamics. The findings may have limited generalizability to other regions or airline carriers. However, the research provides valuable insights into baggage handling performance despite these contextual constraints.

Project Goals and Scope

The scope of this research encompasses an inquiry into the optimal strategies within the industry through a comparative analysis of two distinctive approaches: in-house (organic) and third-party handling. The primary aim is to discern the most effective method by conducting analyses of KPIs, including metrics of efficiency, process quality, and customer satisfaction. We will collect and assess quantitative and qualitative data for this study toward answering the research questions. The purpose is to explore the context of ground-handling scenarios encompassing airports in Brazil, elucidating which strategy contributes to superior outcomes, whether the in-house or outsourced model.

The research scope comprises diversity and specificities by evaluating divergent airports with unique demographics and handling configurations. This analysis will distinguish the strengths and weaknesses of each approach. The outcomes will present industry stakeholders with insights to improve baggage-handling practices throughout aviation. The expected impact of the findings from this study resides in the potential to support airlines in refining their decision-making processes about in-house baggage handling. It will also assist organizations in adopting more efficacious baggage-handling strategies.

List of Terms

In baggage handling, establishing concise definitions for key terms and acronyms fosters a comprehensive understanding of the processes involved for all audiences, facilitating effective communication for the reader and baggage handling procedures awareness.

Definition of Terms

Baggage Handling	The process of transporting, transferring, and managing passengers' luggage and belongings within an airport, from check-in to baggage claim.
Organic	Refers to a company's resources and personnel.
In-house	Done or existing within an organization.
Organic Baggage Handling	An approach to baggage handling in which an airline manages its own ground handling staff and services and handles passenger baggage with its own personnel and equipment.
Third-party	Involving or relating to a third person or organization less directly involved than the principal individuals or organizations.
Third-party Baggage Handling	An approach to baggage handling in which an airline outsources its ground handling services to external companies or service providers responsible for managing and handling passenger baggage on behalf of the airline.
Key Performance Indicator	A set quantifiable measure of performance over time for a specific objective.
PAX	An aviation term used to refer to passengers.
Baggage Claim Index	A metric used to assess the effectiveness of baggage handling operations, typically indicating the number of baggage-related incidents (such as lost or damaged baggage) per 1,000 passengers transported, providing insight into baggage handling performance.

Customer Experience (CX)	Customer's overall impression and satisfaction with the airline's services, including baggage handling, service quality, and interactions, can influence airline perceptions and loyalty.
Mishandled Baggage	Passenger baggage or property mishandled, lost, damaged, or delayed during the baggage handling process.

List of Acronyms

IATA	International Air Transport Association
ANAC	Agência Nacional de Aviação Civil
KPI	Key Performance Indicator
CX	Customer Experience
AI	Artificial Intelligence
HRM	Human Resource Management
BRS	Baggage Reconciliation System
BHS	Baggage Handling System

Literature Review

Baggage Handling Literature Review Summary

References Sources	Reference Summary
Convention for the unification of certain rules for international carriage by air. (1999). Montreal Convention (Doc 9740) (Chapter III - Liability of the Carrier and Extent of Compensation for Damage - Article 17 — Death and Injury of Passengers — Damage to Baggage). https://www.icao.int/Meetings/AirCargoDevelopmentForum-Togo/Documents/9740.pdf	The Montreal Convention of 1999, particularly Chapter III, Article 17, addresses air carriers' liability and compensation procedures for damaged baggage during international travel. This international aviation agreement standardizes guidelines, sets liability limits, and simplifies the resolution of baggage-related disputes, ensuring fairness and consistency across borders. The Convention benefits air carriers and passengers by providing a comprehensive framework to handle baggage issues efficiently, enhancing the travel experience.
Sita (2021). *Baggage IT Insights 2021*. https://www.sita.aero/resources/surveys-reports/baggage-it-insights-2021/	SITA's Baggage IT Insights 2021 report underscores COVID-19's impact on the aviation sector and baggage handling, revealing a continued decline in mishandled bags despite reduced airport and airline staff. The report notes a significant drop in the industry's annual mishandled bag costs. Challenges posed by the pandemic, including reduced passenger numbers and evolving travel regulations, have accelerated the adoption of touchless, self-service technologies and inventive solutions. These innovations aim to enhance passenger confidence, alleviate congestion, and ensure efficient and economical operations at the airport while emphasizing the need for adaptability in the face of changing circumstances.

Nice, K. (1970, January 1). *How baggage handling works*. HowStuffWorks. https://science.howstuffworks.com/transport/flight/modern/baggage-handling.htm	In the article "How Baggage Handling Works" by Kevin Bonsor on HowStuffWorks, the Denver International Airport's baggage handling system is outlined. The article explains the system's core tasks: transferring luggage from check-in to departure gates, facilitating gate-to-gate transfers, and conveying bags to the baggage claim area. It concludes that the efficiency of a successful baggage-handling system is gauged by its ability to match baggage movement speed with that of travelers. Visual aids like images are incorporated to enhance understanding of the baggage handling process's components. Overall, the article effectively communicates the system's essential functions and evaluation criteria while potential areas for more detailed technical explanations and real-world examples are identified.
Baggage tracking. (n.d.). https://www.iata.org/en/services/certification/operations-safety-security/baggage-tracking/	The significance of IATA Resolution 753 for baggage tracking has grown substantially within the aviation sector. This resolution mandates airlines to monitor baggage at four crucial junctures: during passenger handover, aircraft loading, transfer area delivery, and passenger return. The resolution's objective is to curtail the instances of lost or delayed baggage by ensuring comprehensive tracking throughout its transit via intelligent baggage handling systems. This monitoring generates valuable data pinpointing areas necessitating enhanced baggage management procedures, decreasing mishandled baggage, and strengthening operational efficiency within baggage services.

Rijsenbrij, J. C., & Ottjes, J. A. (2007). New developments in airport baggage handling systems. *Transportation Planning and Technology, 30*(4), 417–430. https://doi.org/10.1080/03081060701461899	The article provides an overview of different elements of the baggage handling system and proposes new concepts to improve the processes from check-in through screening until departure, arrival, and claims. The article discusses the current labor-intensive baggage transport system and describes how baggage is transported to and from narrow-body aircraft. The authors propose new concepts, such as automated guided vehicles, self-service baggage drop-off, and RFID (Radio Frequency Identification) technology, to improve the baggage handling system's efficiency. The article also highlights the importance of collaboration between airlines, airports, and baggage handling companies to achieve a more efficient baggage handling system.
Marcellin, F., & Marcellin, F. (2017, July 9). The technology transforming baggage handling. *Airport Technology*. https://www.airport-technology.com/features/featurethe-technology-transforming-baggage-handling-5863548/	The article discusses how technology has improved baggage handling over the last decade, reducing the number of mishandled bags and improving the passenger experience. It highlights the importance of bag-tracking technology and the International Air Transport Association's (IATA) 'Resolution 753', which requires tracking every piece of luggage from check-in to passenger pick-up. The article also mentions BagJourney's features, which help airlines become compliant with Resolution 753. The article also discusses how airports are using increasingly sophisticated technology to streamline baggage handling processes, such as robotic baggage handling, automated check-in conveyors, baggage screening, sorting, make-up, and reclaim, concluding that cloud-based solutions for baggage handling can improve the passenger experience and reduce the number of mishandled bags.

Grohmann, M. Z., Battistella, L. F., & Lütz, C. (2014). Avaliação dos serviços de transporte aéreo brasileiro: análise da imagem e da atitude como antecedentes da intenção de uso. *Gestão & produção*, *21*(1), 215–227. https://doi.org/10.1590/s0104-530x2014005000002	Grohmann, Battistella, and Lütz (2014) study examined the relationship between passengers' image and attitude and their intention to use Brazilian air transport services. Conducted through a survey of passengers at Brazilian airports, the study employed statistical analysis to assess the findings. It concluded that the image and attitude towards Brazilian air transport services significantly influence passengers' intention to use them. This study suggests that enhancing the brand and philosophy towards air transport services can increase their usage in Brazil. It underscores the importance of public perception and attitude in passengers' choice to utilize air transport in the Brazilian context.
Tackling the airport baggage handling problem. (2023, March 28). https://www.inform-software.com/blog/post/tackling-the-airport-baggage-handling-problem-of-lost-or-mishandled- pieces	The article addresses the issue of lost or mishandled airport baggage, attributed to factors like transfer mishandling, loading errors, and security issues. According to the Department of Transportation's Air Travel Consumer Reports, approximately seven out of every 1,000 handled bags are estimated to become lost baggage. Airports and airlines are taking steps to rectify this issue. Denver International has introduced an upgraded baggage handling system to enhance efficiency and reduce losses, while Hefei Xinqiao Airport plans to implement advanced sorting technology. Passengers have also proposed remedies such as remote processing and self-service options like home bag-tag printing and remote bag check-in. A practical solution lies in utilizing baggage handling optimization software, allowing early detection and resolution of potential issues through analyzing passenger and baggage connections. This real-time approach can potentially enhance baggage handling for improved airline operations.

RESOLUÇÃO Nº 400, 13/12/2016 — Agência Nacional de Aviação Civil ANAC. (n.d.). https://www.anac.gov.br/assuntos/legislacao/legislacao-1/resolucoes/resolucoes-2016/resolucao-no-400-13-12-2016	The ANAC Resolution No. 400, dated December 13, 2016, sets forth vital guidelines for baggage transport on commercial flights in Brazil. Its purpose is to ensure equitable standards in baggage transport, that passengers have access to transparent information, and that their rights are respected.
Reason for lost codes. (n.d.). Scribd. https://pt.scribd.com/doc/201710160/Reason-for- Lost-Codes	The "Reason for Lost Codes" document available on Scribd presents a table reflecting the IATA (International Air Transport Association) model for coding reasons behind lost baggage. This coding system provides a standardized way to categorize and track the factors and circumstances that lead to baggage being misplaced or lost during air travel. It is an essential tool in the aviation industry for improving handling and managing baggage-related issues.
Fitz-Gibbon C. T. (1990). *Bera dialogues. vol. 2 performance indicators*. Multilingual Matters.	Performance indicators are crucial in tracking the performance of complex systems, such as education, healthcare, and transportation. They are collected regularly and provide valuable information about the system's functioning. While performance indicators are not perfect measures and may have errors or problems of definition and interpretation, they serve as essential pointers for quality control and system management.
What is CX? (2022, July 15). Mckinsey.com; McKinsey & Company. https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-cx	The article highlights the importance of customer experience (CX) in today's digital age. CX encompasses all customer interactions with a brand and is influenced by digital and physical interactions. CX aims to deliver superior experiences, value, and growth for customers. This can be achieved by improving and optimizing interactions between consumers and brands,

	measuring CX results, and implementing a customer-centric culture. CX extends beyond customer service and relationship management and includes factors such as brand perception, product experience, pricing, and service. Companies can ensure that every customer touchpoint reflects the brand's promises by prioritizing CX and using customer insights.
Appelbaum, S. H., & Fewster, B. M. (2003). Global aviation human resource management: contemporary compensation and benefits practices. *Management Research News*, *26*(7), 59–71. https://doi.org/10.1108/01409170310783592	The article discusses the vital role of human resource management (HRM) in the aviation industry, emphasizing compensation and benefits. The authors argue that a traditional, product-centric industrial model no longer suits the industry's needs in a highly competitive and safety-sensitive sector. HRM, specifically compensation and benefits strategies, are essential to adapt to the evolving demands of a customer-centric, knowledge-based service market. The study draws from an audit, which included executive respondents and data from multiple airlines across nine countries. The authors highlight disparities between perceived HRM practices and the reality within the aviation industry. The article recommends HRM audits, collaboration for industry-specific audits, employee opinion surveys, information gathering, and expanded training and development initiatives as essential for industry improvement.

Methodology

Research Design

Baggage handling performance is a critical aspect of airport operations that significantly impacts the passenger experience. The global market size of the airport baggage handling system is expected to grow considerably in the coming years, with some reports projecting it to reach USD 16.12 billion by 2030. The baggage handling system market is projected to grow at a CAGR of 6.6%, from USD 7.5 billion in 2020 to USD 10.3 billion by 2025. The market size for global baggage handling was valued at USD 8.55 billion in 2019 and is projected to reach USD 14.79 billion by 2027, at a CAGR of 7.2%. Mishandled baggage is a significant issue in the aviation industry, and airlines continuously look for ways to improve their baggage handling performance.

According to the ITA Baggage IT Insights 2022 report, the global airline industry significantly impacts cost and customer experience concerning the baggage journey. The report points out that in 2022, 26 million pieces of baggage were mishandled, costing airlines US$2.2 billion. To mitigate the adverse effects of mishandled baggage on baggage handling efficiency and passenger satisfaction, actions are necessary, but they vary according to issues such as infrastructure, local labor laws, the operational level of airports, the type of administration (public or private), and the passenger public. Managing this demand is a significant challenge for airline operators, aerodrome operators, and even the government in some countries.

As air travel continues to grow, the demand for efficient and effective baggage handling systems will remain a priority for the aviation industry. In Brazil, the improper handling of baggage is a major concern for airlines, as it can result in damage, loss, and delays in delivery to the customer. This aspect is crucial to these companies' operational management and

customer satisfaction. In this context, ground handling teams play a fundamental role, as their competence and efficiency are vital in avoiding these unwanted occurrences. Therefore, whether outsourced or organic, the quality of the service provided by these teams is a determining factor in airlines' quest for operational excellence.

Data Collection

This study will compare results using baggage performance indicators for a given airline regarding lost and damaged checked baggage, considering the in-house and third-party ground handling operations at four Brazilian airports in 2022. It is worth noting that the airports selected for this research were chosen based on specific criteria, such as the approximate number of flights, passengers boarded, and baggage checked during the study period. In addition, these airports were chosen because they are home to both outsourced and organic ground handling operations, covering various geographical regions of Brazil, namely:

- FOR - Fortaleza Airport - Northeast – Outsourced;

- POA - Porto Alegre Airport - South – Outsourced;

- SDU - Santos Dumont Airport - Southeast – Organic; and

- BSB - Brasília Airport - Midwest – Organic.

Based on the analysis of the data collected, the main objective of this study is to verify whether there is a statistically significant difference between the ground-handling services offered by these airports.

Data Analysis

Commercial aviation in Brazil concentrates approximately 95% of its passenger and cargo volume on three airlines. These three leading airlines have their dashboards, KPIs, and metrics to determine flight baggage handling performance. Because of this complexity, this study

aims to analyze the data of a specific Brazilian airline, one of the three most prominent in the country, in terms of its baggage handling performance at four airports in Brazil.

The selection of the airports to be analyzed was based on the number of passengers, flights, and checked baggage. It was decided to select two airports with an organic ground handling service and two airports with an outsourced service. Once the data is collected, it will be subjected to the statistical test of relevance (T-test) for a qualitative understanding of the data to make all the airports statistically comparable.

The data collected generates an index within the airlines for this study. The index consists of the number of incidents per 1,000 passengers transported. There is a specific target for each airport so that the variance between the number of passengers at each airport is not a determining factor in the quantitative view.

Table 1

Baggage dashboard - 2022

Date	Airport	PAX	Flights	Bag Claims	Bag Claims Goal	Bags	Customer Experience Grade	Customer Experience Goal	Provider
Jan	SDU	119650	1031	1.3	2.0	28878	65.82	56.54	In House
Feb	SDU	99655	927	1.1	1.7	19788	63.77	56.55	In House
Mar	SDU	110945	978	1.2	1.1	20540	67.48	56.57	In House
Apr	SDU	127168	1192	0.9	0.9	23519	69.80	56.52	In House
May	SDU	133436	1376	1.0	0.9	22708	67.81	56.53	In House
Jun	SDU	129032	1262	0.9	0.9	23276	68.63	56.53	In House
Jul	SDU	152790	1351	1.1	1.4	28752	67.66	56.54	In House
Aug	SDU	151821	1336	1.0	1.3	25752	63.70	56.51	In House
Sep	SDU	144284	1285	1.4	1.3	26286	65.78	56.54	In House
Oct	SDU	149728	1332	1.1	1.2	28535	65.90	56.53	In House
Nov	SDU	172113	1510	1.6	1.3	30566	59.88	56.52	In House
Dec	SDU	145817	1534	1.9	1.5	27975	61.42	56.51	In House
Jan	BSB	328250	2227	3.6	3.8	35148	57.87	53.52	In House
Feb	BSB	234520	1620	3.1	3.3	24436	65.14	53.53	In House
Mar	BSB	244950	1744	2.8	2.3	25972	66.26	53.51	In House

Apr	BSB	191668	1439	2.4	2.4	26705	65.55	53.52	In House
May	BSB	196880	1668	2.3	2.4	28380	71.78	53.53	In House
Jun	BSB	204135	1621	2.6	2.4	29038	68.32	53.52	In House
Jul	BSB	299966	2130	2.9	3.2	42012	61.91	53.52	In House
Aug	BSB	299657	2035	3.4	3.0	37951	60.77	53.51	In House
Sep	BSB	290243	1997	3.3	3.0	31930	64.88	53.52	In House
Oct	BSB	293558	2028	2.8	2.8	30014	67.32	53.51	In House
Nov	BSB	303896	2061	3.4	3.3	34966	61.17	53.52	In House
Dec	BSB	305471	2186	3.4	3.5	40912	62.10	53.51	In House
Jan	FOR	118351	733	2.4	2.4	33697	54.22	54.88	Outsourced
Feb	FOR	97512	616	2.2	2.1	24226	65.60	54.90	Outsourced
Mar	FOR	103493	676	2.2	1.5	24859	62.88	54.90	Outsourced
Apr	FOR	79534	518	2.4	1.6	21497	59.27	54.90	Outsourced
May	FOR	85262	572	2.3	1.6	22845	58.54	54.91	Outsourced
Jun	FOR	81777	543	2.1	1.6	23309	57.49	54.93	Outsourced
Jul	FOR	122842	782	2.5	2.2	35544	57.71	54.94	Outsourced
Aug	FOR	128695	759	2.7	2.0	34347	51.28	54.90	Outsourced
Sep	FOR	107818	680	2.8	2.1	29744	53.96	54.94	Outsourced
Oct	FOR	113651	705	2.9	1.9	30028	60.41	54.87	Outsourced
Nov	FOR	127851	775	3.3	2.1	31827	57.78	54.92	Outsourced
Dec	FOR	118425	796	3.6	2.2	30714	56.23	54.87	Outsourced
Jan	POA	88854	574	2.1	2.8	32221	59.09	52.59	Outsourced
Feb	POA	60785	481	1.1	2.4	19736	58.09	52.64	Outsourced
Mar	POA	72940	497	1.9	1.7	22986	58.98	52.64	Outsourced
Apr	POA	76167	538	1.5	1.4	25627	60.22	52.62	Outsourced
May	POA	80190	638	2.0	1.4	28887	60.75	52.55	Outsourced
Jun	POA	82181	604	2.0	1.4	30222	62.01	52.59	Outsourced
Jul	POA	103683	681	1.8	2.0	38568	56.98	52.56	Outsourced
Aug	POA	103561	665	1.7	1.9	35254	54.57	52.57	Outsourced
Sep	POA	94061	648	1.6	1.9	32914	59.19	52.56	Outsourced
Oct	POA	90919	652	1.4	1.8	30950	62.25	52.56	Outsourced
Nov	POA	108891	694	1.6	2.0	40211	53.69	52.56	Outsourced
Dec	POA	92872	675	1.5	2.2	31193	60.39	52.59	Outsourced

Note. Data collected from Brazilian airlines representing baggage handling operations and customer experience scores for the airports analyzed, including outsourced and in-house solutions.

Data Analysis Report

The data analysis aimed to provide insights and conclusions into the performance of in-house (organic) and outsourced ground handling services within a specific Brazilian airline. To perform this analysis, we gathered data from the airline's KPIs. The data included passenger volume, flight operations, baggage handling, baggage incidents index, and customer experience. These factors were used to assess the impact of the ground handling strategy on the airline's operations.

Customer Experience – Analysis

Null Hypothesis (H0): There is no difference in Customer Experience Grade between In-House or Outsourced ground handling services. Based on a two-tailed, two-independent sample t-test at a .05 level of significance, the mean Customer Experience Grade In-House (n = 24, M = 65.030, SD = 3.40) was higher than the mean Customer Experience Grade Outsourced (n = 24, M = 58.398, SD = 3.31), p = 1.61E-08. The null hypothesis was therefore rejected. CX Grade means were statistically different.

Table 2

t-Test: Two-Sample Assuming Equal Variances - Customer Experience

	In-House	Outsourced
Mean	65,0301085	58,39882131
Variance	11,62131964	10,96252961
Observations	24	24
Pooled Variance	11,29192463	
Hypothesized Mean Difference	0	
df	46	
t Stat	6,836038105	
P(T<=t) one-tail	8,02942E-09	
t Critical one-tail	1,678660414	
P(T<=t) two-tail	1,60588E-08	
t Critical two-tail	2,012895599	

Note. Null Hypothesis (H0): There is no difference in Customer Experience Grade between In-House or Outsourced Ground Handling Services.

Table 3

t-Test: Two-Sample Assuming Equal Variances - Customer Experience in SDU and BSB

	SDU	*BSB*
Mean	65,63768084	64,42253616
Variance	8,793456965	14,70026052
Observations	12	12
Pooled Variance	11,74685874	
Hypothesized Mean Difference	0	
df	22	
t Stat	0,86844584	
P(T<=t) one-tail	0,19726282	
t Critical one-tail	1,717144374	
P(T<=t) two-tail	0,394525641	
t Critical two-tail	2,073873068	

Note. Null Hypothesis (H0): There is no difference in Customer Experience Grade between SDU or BSB Ground Handling Services.

Table 4

t-Test: Two-Sample Assuming Equal Variances - Customer Experience in FOR and POA

	FOR	*POA*
Mean	57,94652512	58,85111749
Variance	15,32372541	7,151588847
Observations	12	12
Hypothesized Mean Difference	0	
df	19	
t Stat	-0,660983563	
P(T<=t) one-tail	0,258279156	
t Critical one-tail	1,729132812	
P(T<=t) two-tail	0,516558311	
t Critical two-tail	2,093024054	

Note. Null Hypothesis (H0): There is no difference in Customer Experience Grade between FOR or POA Ground Handling Services.

Baggage Claim Index – Analysis

Null Hypothesis (H0): There is no difference in the Baggage Claim Index between In-House or Outsourced ground handling services. Based on a two-tailed, two-independent sample t-test at a .05 level of significance, the mean Baggage Claim Index In-House (n = 24, M = 2.111, SD = 0.976) was lower than the mean Baggage Claim Index In-House (n = 24, M = 2.138, SD = 0.605), p = 0.91059817. The null hypothesis was, therefore, not rejected. Baggage Claim Index means were statistically not different.

Table 5

t-Test: Two-Sample Assuming Unequal Variances - Bag Claim

	In-House	*Outsourced*
Mean	2,111864957	2,138385398
Variance	0,954398202	0,366744831
Observations	24	24
Hypothesized Mean Difference	0	
df	38	
t Stat	-0,113034612	
P(T<=t) one-tail	0,455299085	
t Critical one-tail	1,68595446	
P(T<=t) two-tail	0,91059817	
t Critical two-tail	2,024394164	

Note. Null Hypothesis (H0): There is no difference in the Baggage Claim Index between In-House or Outsourced Ground Handling Services.

Data Analysis Considerations and Conclusion

Considering the airports analyzed in this study, which are compatible with the number of movements, passengers, and checked baggage, we also conducted additional t-tests to compare customer experience between these airports for in-house and outsourced services. The results showed differences in customer experience between the selected airports as we rejected the null hypotheses stating that there is no difference in customer experience grade between in-house or outsourced ground handling services.

Our data analysis indicates a significant distinction in customer experience between in-house (SDU and BSB airports) and outsourced ground handling (FOR and POA airports) services in a specific Brazilian airline. However, there is no significant differentiation between the two types of services in flight operations and baggage handling during the analyzed period. The null hypotheses for the baggage claim index were accepted.

The findings of this analysis hold significant implications for the specific Brazilian airline's ground handling operations. The observed differences in customer experience between in-house and outsourced services provide actionable insights that can guide strategic decisions. Nevertheless, it is crucial to acknowledge that these conclusions are based on the specific dataset and timeframe analyzed. Further research and analysis are warranted to gain a comprehensive understanding of the long-term implications and potential causal factors behind these differences.

Ethical Considerations and Limitations

The situation in Brazil concerning checked baggage on airplanes is related to the deregulation of checked baggage allowances, which allows airlines to sell tickets with different types of checked baggage allowances or even without this benefit for passengers who choose not to use this service. Charging for checked baggage can be advantageous for airlines, as it allows them to offer lower ticket prices and encourage passengers to take less baggage. Doing this also can reduce the plane's weight and, consequently, fuel consumption.

However, this measure can negatively impact passengers. Such as increasing ticket prices, reducing the amount of baggage checked in by passengers, and losing passengers' rights to check-in baggage for free on national trips. In addition, the COVID-19 pandemic has significantly impacted the airline industry, with a reduction in passenger demand and an increase in lost baggage rates (Teizen, 2023).

Project Outcomes

Numerous factors impact airlines' reliability in today's industry. This includes metrics like on-time arrivals, cancellations, flight diversions, mishandled baggage, runway waits, and involuntary denied boarding situations. Additionally, several organizations evaluate these processes globally to determine whether a given airline's customer experience is superior or inferior.

This study analyzed the baggage handling performance and the impact of baggage services on customer experience by comparing in-house and outsourced ground handling providers at airports. The data showed a substantial disparity in customer experience between the two services. Customer experience was notably inferior at airports where baggage services were outsourced. Enhancing baggage handling performance in commercial aviation necessitates a multifaceted approach. As discussed in this paper, it involves some critical factors in the decision-making process of airline management.

Results

To discuss and illustrate the areas of improvement that can help streamline baggage handling performance, the findings presented below include both technological advances and effective human resource management (HRM). The focus is primarily on human capital management and how airlines can benefit from human resource transformation, regardless of the ground-handling solution adopted.

Technology Transforming Baggage Handling

IATA Resolution 753 requirements for airlines is to track baggage at four main touchpoints (preparation, loading, transfer, and arrival). Throughout the baggage journey, tracking has helped reduce the number of mishandled bags in recent years, and technology has

played an increasingly important role in transforming baggage handling to make it more efficient, secure, and sustainable. One of the steps to more efficient baggage handling is to implement baggage tracking at the loading stage. Baggage Reconciliation Systems (BRS) are a valuable means of improving the baggage process and tracking each piece. Implementing BRS has proven beneficial for several airlines, including Etihad Airways, which reported a 33% improvement in mishandled baggage in 2018 compared to the previous year after implementing BRS technology at its Abu Dhabi hub (International Airport Review, 2021).

Likewise, airlines have invested in mobile applications that enable passengers to monitor the whereabouts of their baggage. Such apps offer instantaneous updates on the location and status of passenger baggage, promoting transparency and giving travelers a sense of assurance about their possessions. Automated baggage handling systems, integrated with artificial intelligence (AI) and machine learning systems, optimize baggage flow from check-in to the aircraft hold and reduce the likelihood of mishandled or misplaced baggage. The global airport baggage handling software market size is projected to grow from $1.57 billion in 2023 to $2.75 billion by 2030, at a CAGR of 9.63%, demonstrating the importance and continuous application of technology and improved systems (*Airport Baggage Handling Software Market Analysis [2023-2030]*, 2023).

Data show that while passenger numbers increased by 1.2 billion over the past decade, mishandled bags decreased to just over 20 million (Marcellin & Marcellin, 2017). Additionally, according to SITA, the number of mishandled bags has increased to 4.35 per thousand passengers in 2021 (*Air Transport IT Insights 2022*, 2022). Technology investments in improving automation and self-service have become a priority for achieving operational efficiencies. However, airline companies must recognize the critical link between human capital management

and baggage handling performance. While advanced technology can streamline operations, well-trained and motivated staff are equally important. Promoting employee empowerment, development, fair compensation, and a supportive work environment fosters a competent and engaged workforce.

Human Resource Management within Aviation

Human Resource Management (HRM) strategies can significantly improve airline baggage handling operations. Within this HRM framework, some of the initiatives and programs available include employee engagement, self-belonging, and career progression. Research indicates that more investment in frontline employees leads to fewer consumer complaints (IATA, 2023). To better understand and explore the impact of human behavior on an organization's indicators, it is crucial to recognize that some factors directly influence that behavior.

Employee Engagement

Employee motivation is vital for airlines to achieve optimal baggage handling performance. High motivation levels lead to various benefits, including increased efficiency, productivity, retention, and overall job satisfaction among baggage handling staff. However, Gallup reports that only 13% of employees are engaged at work, highlighting a significant opportunity for airlines to improve their operations (Gallup, Inc., 2023).

Self-Belonging

A sense of belonging emerged as one of the strongest drivers of employee engagement, along with other factors such as trust in leadership and opportunities for career growth. A sense of belonging is a strong indicator that an employee is engaged. These individuals solve problems,

are likely to take on additional responsibilities, get along with co-workers, and grow and develop more rapidly.

Career Progression

Strategic training and career development investments enable frontline employees to enhance an organization's knowledge base. Doing so can elevate productivity, service quality, and improve customer satisfaction. Additionally, research indicates that frontline employees' authenticity and perceived effort create customer trust and satisfaction, resulting in a beneficial cycle of positive feedback.
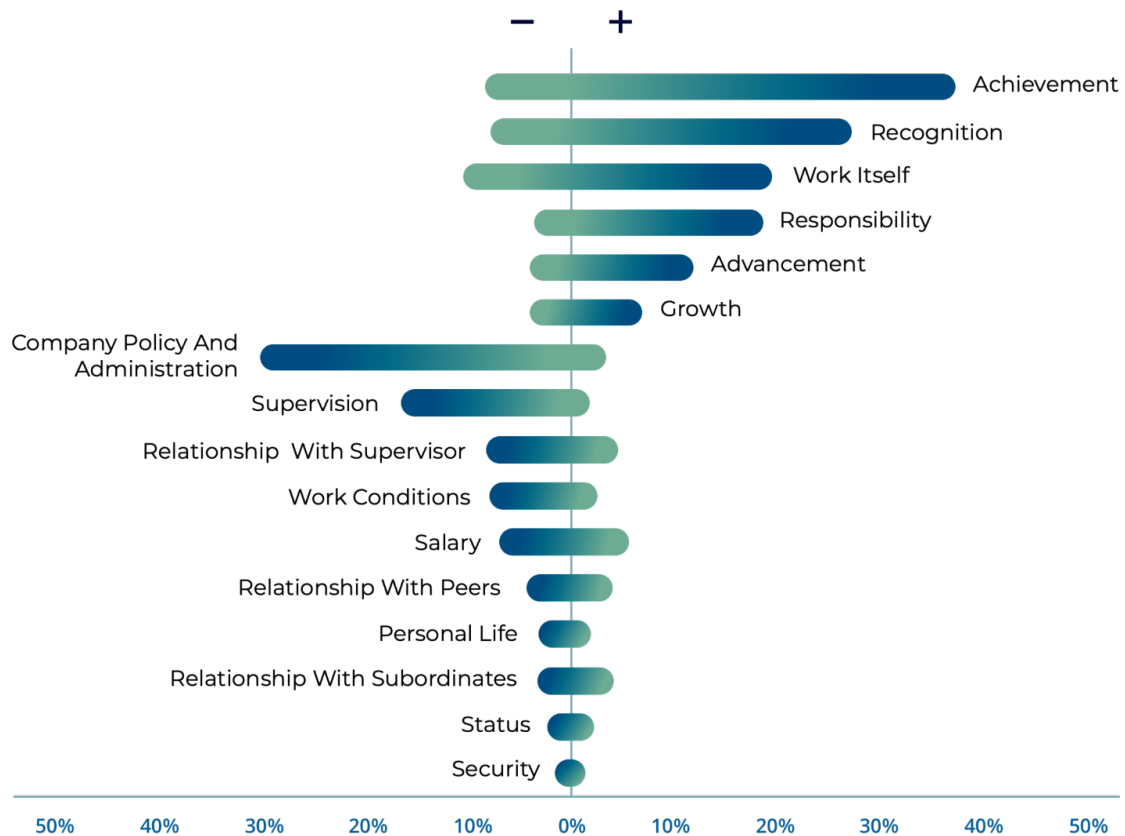
Herzberg's Two-Factor Theory

To address the human factors within the commercial aviation industry, we will explore how airlines can apply Herzberg's Two-Factor Theory of motivation to enhance employee engagement. Employee motivation can ultimately achieve better baggage handling results. This study investigated the key considerations for airlines when promoting and monitoring performance for both organic and outsourced baggage handling solutions. The specific focus was on innovative contract design for third-party baggage handling.

According to Herzberg, people are motivated by various needs, which vary in order of importance and over time or in different situations. In this theory, Herzberg states that two factors drive an employee's behavior: hygiene and motivation. (Lundberg et al., 2009). Hygiene factors are the primary factors that keep an employee minimally assisted in the workplace. For example, adequate pay, a clean and safe workplace, a good climate in interpersonal relationships, engaged leadership, and transparent policies and rules. According to the team's profile, the motivation factor involves recognition, an individual career plan, achievements, purpose, and leadership styles.

Figure 1

Example of Frederick Herzberg's two-factor theory

Note. Herzberg's set of motivators and demotivators according to his motivation-hygiene theory, also known as Herzberg's two-factor theory. Retrieved from Henrik Dannert's Employee Motivation and the Herzberg Theory article.

According to Latham and Pinder (2005), there is no single definition of work motivation due to the complexity of the concept. Some theorists find it more helpful to focus on physiological aspects, while others emphasize behavioral characteristics and the rationality of human beings. Genuine concern for individuals is crucial to the success of an organization. We are witnessing a generational shift from Millennials to Gen Z, and this transition will be no different in professional relationships. The alignment of employee needs with those of the

company is essential, where work should possess intrinsic purpose and contribute to overall well-being, both within and beyond the workplace.

Understanding and exploring the impact of human behavior on an organization's performance indicators is essential for delivering excellence. Recognizing individuals for their exemplary work guarantees that positive actions will be reinforced and more likely to be repeated. This demonstrates the effectiveness of positive reinforcement theory, developed by Frederick Skinner, the founding father of behavioral psychology (Schlinger, 2011).

Practical Application of Herzberg's Two-factor Theory in Baggage Handling

Based on motivation-hygiene theory, the practical application for baggage handling is implementing motivational factors that foster the airlines' human capital, whether using organic or outsourced solutions. To achieve the objectives, constant monitoring of HRM indicators is necessary for a qualitative analysis of baggage handling performance. The organizational development proposed by these initiatives through monitoring of KPIs such as:

- Employee Adherence/Turnover Rate;

- Employee Engagement;

- Absenteeism Rate;

- Training and Development Investment;

- Performance Appraisal Effectiveness;

- Diversity and Inclusion Metrics;

- Employee Satisfaction and Net Promoter Score (NPS);

- Health and Wellness Metrics;

- Succession Planning.

Conclusions and Recommendations

Conclusions

Investments in technology suggest an improvement and a positive impact on increasing baggage handling performance. However, these innovative technologies and systems demand substantial capital. Brazilian aviation industry, airlines, and airports do not give precedence to investing in such advancements.

Furthermore, outsourcing companies specializing in ground handling should focus on their human resource management. This may entail improving compensation and benefits, implementing recognition programs, developing career plans, and standardizing services through diverse training and qualification courses. This is different from the current service provision model solely focused on cost reduction.

When an airline operates its own ground handling service, it adheres to the company's established policies and organizational culture. Nevertheless, third-party services often lack the same commitment and sense of responsibility to the contracted airline. The disconnect between employees of the service provider and the contracted airline can result in operational problems. Bringing this to the reality of outsourced teams, it is necessary for contracting vendors to prioritize the observation of these factors. Through consistent monitoring, vendors can ensure that the level of demand in achieving targets must be aligned with the level of structure and tools provided to workers.

It is suggested that during the contract design, an innovative design that includes items listed in the Herzberg theory must be included and monitored by both parties. The employee needs to feel encouraged in both methodologies (organic and third-party), and there must be no discrepancy in people management between these two approaches. There are internal cultural

differences in each organization. However, both parties must consider essential motivational items. This way, the working environment becomes more conducive to the employees, making them feel genuinely active and engaged in achieving the proposed results. Motivation results from the interplay between individuals and their surroundings, forming a psychological process.

Providing outsourced and organic staff with proper tools and training to manage baggage effectively boosts operational performance and strengthens an airline's reliability and customer service reputation. Ultimately, investing in human capital management is crucial to attaining the highest standards in baggage handling. As this study is limited by the demographics of comparable airports in Brazil, we recommend expanding the dataset, if feasible, to include parameters applicable to multiple airlines. This will yield more statistical data to validate our initial findings.

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Appendix A

Tables

A1   Descriptive analysis of the dashboard used in the data analysis.

Passengers In-House	
Mean	201234.7083
Standard Error	15439.38457
Median	181890.5
Mode	#N/A
Standard Deviation	75637.22828
Sample Variance	5720990302
Kurtosis	-1.445261938
Skewness	0.396665129
Range	228595
Minimum	99655
Maximum	328250
Sum	4829633
Count	24
Confidence Level(95.0%)	31938.80039

Passengers Outsourced	
Mean	97513.13
Standard Error	3765.969
Median	95786.5
Mode	#N/A
Standard Deviation	18449.4
Sample Variance	3.4E+08
Kurtosis	-0.79479
Skewness	0.034649
Range	67910
Minimum	60785
Maximum	128695
Sum	2340315
Count	24
Confidence Level(95.0%)	7790.5

Flights In-House	
Mean	1577.916667
Standard Error	80.86983899
Median	1522
Mode	#N/A
Standard Deviation	396.1796822
Sample Variance	156958.3406
Kurtosis	-1.079434406
Skewness	0.170560938
Range	1300
Minimum	927
Maximum	2227
Sum	37870
Count	24
Confidence Level(95.0%)	167.2920079

Flights Outsourced	
Mean	645.9167
Standard Error	18.54068
Median	658.5
Mode	#N/A
Standard Deviation	90.83043
Sample Variance	8250.167
Kurtosis	-0.79818
Skewness	-0.15742
Range	315
Minimum	481
Maximum	796
Sum	15502
Count	24
Confidence Level(95.0%)	38.35433

Bag Claims In-House		_Bag Claims Outsourced_	
Mean	2.111864957	Mean	2.138385
Standard Error	0.199415626	Standard Error	0.123616
Median	2.105475269	Median	2.092674
Mode	#N/A	Mode	#N/A
Standard Deviation	0.976933059	Standard Deviation	0.605595
Sample Variance	0.954398202	Sample Variance	0.366745
Kurtosis	-1.683605243	Kurtosis	0.163421
Skewness	0.144541766	Skewness	0.622983
Range	2.720684161	Range	2.461628
Minimum	0.864997484	Minimum	1.118697
Maximum	3.585681645	Maximum	3.580325
Sum	50.68475896	Sum	51.32125
Count	24	Count	24
Confidence Level(95.0%)	0.412522652	Confidence Level(95.0%)	0.25572