

TRAVEL ANALYTICS FOR BUSINESS INTELLIGENCE: THE CASE OF ITALIAN INSTITUTE OF STATISTICS

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Abstract. In this paper, an administrative data base for internal use is treated to show the power of the Business Intelligence for increasing the efficiency of the management system. It is not just a tool for understanding the “status quo” of Istat human resources but it is a set of statistical analysis to construct a strategy for improving the “idea” of modern Public Administration. As part of the Business Intelligence (BI) process, organizations collect data from internal IT systems and external sources, prepare it for analysis, run queries against the data and create data visualizations, BI dashboards and reports to make the analytics results available to business users for operational decision-making and strategic planning. The duty travel information selected from administrative Istat data base are made up of a several variables which include employee identification data (registration number, profile, staffing plan), duty travel administrative data (number of assignments, duration, destination, object, and institution visited, cost center) and finally, the detail of the cost items for single duty travel expenditure (type of transport, board and lodging).

1. Introduction

In this paper, an administrative database for internal use is constructed to show the strength of Business Intelligence for increasing the efficiency of the management system. It is not just a tool for understanding the “status quo” of Istat Human Resources (HR) but it is a set of statistical analysis to construct a strategy for improving the “idea” of modern Public Administration.

The Business Intelligence (BI) is a technology-driven process for analyzing data and delivering actionable information that helps executives, managers and workers make informed business decisions (De Vivo, Polzonetti, Tapanelli, 2011). As part of the BI process, organizations collect data from internal IT systems and external sources, prepare it for analysis, run queries against the data and create data visualizations, BI dashboards and reports to make the analytics results available to business users for operational decision-making and strategic planning. In particular, statical analysis for BI plays a crucial role in:

- data-driven Decisions: Statistics provides the tools to analyze vast amounts of data, uncovering patterns, trends, and relationships that might not be

obvious otherwise. Your research can contribute to this process by identifying new insights and correlations that can fuel innovative ideas;

- **quantifying Impact:** Innovation often thrives on taking risks. Statistics helps assess the potential impact and viability of those risks. Your research findings can inform these calculations, providing a data-backed foundation for groundbreaking solutions;
- **benchmarking and Improvement:** Statistics allows us to compare new innovations to existing solutions. Your research can create new benchmarks, measuring the effectiveness of emerging technologies or processes, and pushing the boundaries of what's possible;
- **hypothesis Testing and Experimentation:** Innovation requires testing and refinement. Statistical methods enable the creation of robust experiments to validate new ideas and optimize their performance. Your research can contribute to this process by designing statistically sound experiments that yield reliable results.

The duty travel information selected from administrative Istat database are made up of a several variables which include employee identification data (registration number, profile, staffing plan), duty travel administrative data (number of assignments, duration, destination, object, and institution visited, cost center) and finally, the detail of the cost items for single duty travel expenditure (type of transport, board and lodging) (Dentini, Mazziotta, Zeppieri, 2022).

The data analysis covers the years 2009-2023 (Fourteen years of time series!) So that it is possible to assess the situation before, during and after the pandemic crisis.

The first phase towards the construction of the database involved the transposition of the raw matrix to obtain the single duty travel for each record (row). The statistical analyzes used have extracted from a very large matrix of unstructured administrative data the information necessary to design strategic company policies aimed at saving and investing towards new strategies for enhancing professional skills. In fact, the ability to reduce the costs of missions through the signing of agreements with service providers is a goal that Istat will pursue in the coming years.

The paper is one of the first example of Business Intelligence (BI) in Istat, in which data purely used for administrative matters are used to obtain useful information for the management of activities, economic savings policies, relations with other institutional organizations and much more. We are talking about a wealth of information to be exploited to increase the effectiveness of some internal and external processes of the Istat.

The paper is structured as follows. In the second section, the pandemic effect on the tourism sector is presented; in the third section, the results of the analysis are focused; in the fourth the concluding remarks are highlighted.

2. The pandemic effect on the tourism sector

Following the pandemic, the tourism market experienced an unprecedented and extraordinary season. The geopolitical scenario further influenced the international environment. The rising cost of oil and energy, in general, led to widespread price increases in all sectors, including tourism, driving up prices for hotel and transportation services.

Table 1 – Cost variation (%) for flights and rail transport.

	2021 - 2022	2022 – 2023
Domestic flights	21%	44%
European flights	128%	43%
Intercontinental flights	46%	16%
Rail transport	14%	13%

Istat

Due to the economic crisis, the entire tourism industry has also suffered considerable hardship as a result of severe staff shortages mainly due to the large number of layoffs made between the year 2020 and 2021. During 2022, in the airline industry, the increase in airline ticket prices for international and domestic flights was due to both the increase in the price of fuel and a general increase in inflation, which led to a truly staggering increase in airline ticket costs. Istat has estimated, compared to 2021 that airline ticket prices have increased by 90 percent. This is a really significant and unprecedented price change, and the most significant increases are mainly in international flights. In 2022, airline tickets for international flights increased by 128% compared to the year 2021 and 92% compared to 2020.

As for domestic flights, the change in air ticket prices in 2022 is smaller, in fact there was a 21% increase compared to 2021.

The increase in airline ticket prices is also evident in 2023, in fact, the high fuel prices and other difficulties that have affected the industry have shown an increase in flight prices by an average of 40% compared to 2022 (Istat data referring to May). Note that as of May 2023, overall inflation was 8.3%.

The largest increase compared to the year 2022 is in domestic flights, which go up by 44 %; while intercontinental flights show a smaller increase (16 %) compared to May 2022. The price increase related to passenger travel does not only affect air transportation; in fact, maritime transportation has also been mainly affected by the situation related to the increase in fuel costs. In 2022, sea transportation fares were increased by 19% compared to 2021, although looking at the trend of fares, there was already a 21% increase last year compared to 2020 (data not in tableII costo

degli spostamenti ferroviari, come evidenziato in Tabella 1, mostra un aumento inferiore rispetto ai voli e al trasporto marittimo. In fact, prices increase 14 % from the year 2021 to the year 2022 and 13 % from 2022 to 2023.

The hotel industry has been hard hit by the Covid-19 pandemic. The forced closure of many accommodations, staff reductions, and increased costs have had a significant impact on hotel supply and prices, with major consequences for business travel as well. According to Federalberghi's estimate, the closure of 180 hotels in Rome, as in other cities, has posed a real problem for those who have to go on duty travel. This reduction in supply, combined with increased post-pandemic demand, has made the sector less competitive, especially during peak season.

The increase in flight and hotel prices, along with other critical issues in the tourism sector, has generated a significant impact on government business travel expenses.

Entering into agreements with transportation provider companies and hotel facilities is an effective strategy to contain costs and protect the Public Administration from excessive outlays. This strategy demonstrates the Administration's focus on savings and efficiency, strengthening its image to employees and citizens. Entering into agreements requires careful evaluation and planning, which is already present in Istat's strategic policy (Dentini e Zeppieri, 2023).

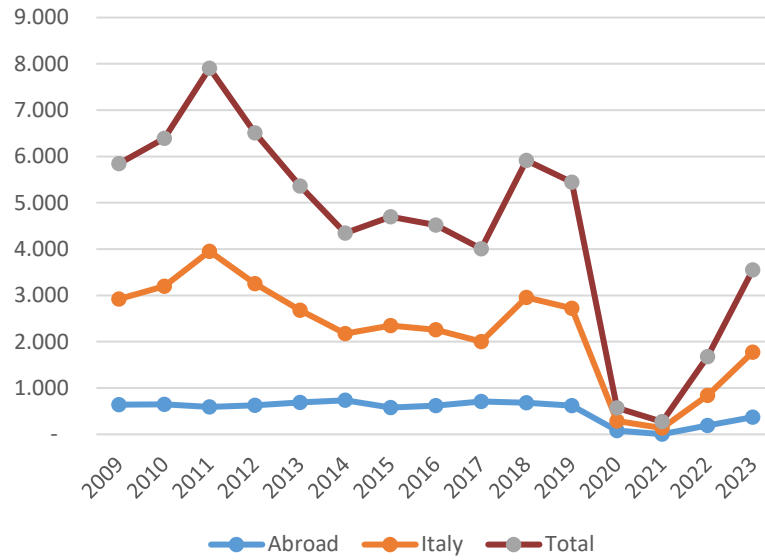
3. Analysis of the results

The descriptive analyses in this section allow us to focus on time-series data to study trends and increase awareness of appropriate strategic decisions. The goal of the analyses and to bring out evidence that can guide the decision maker in making optimal choices toward strategic business travel planning. In short, Business Intelligence becomes an irreplaceable tool for Istat's internal management.

In the figure 1, Duty travel by year and destination is presented. From Figure 1 we can see how the number of duty travel is distributed over the time period considered. It is easy to see how the duty travel peaks occur at the traditional censuses in 2010 and 2011 and the beginning of the continuous population census in 2018 and 2019. It is evident that, during the Covid period, duty travel are drastically reduced. The number of duty travel abroad seems to be constant except for the Covid time.

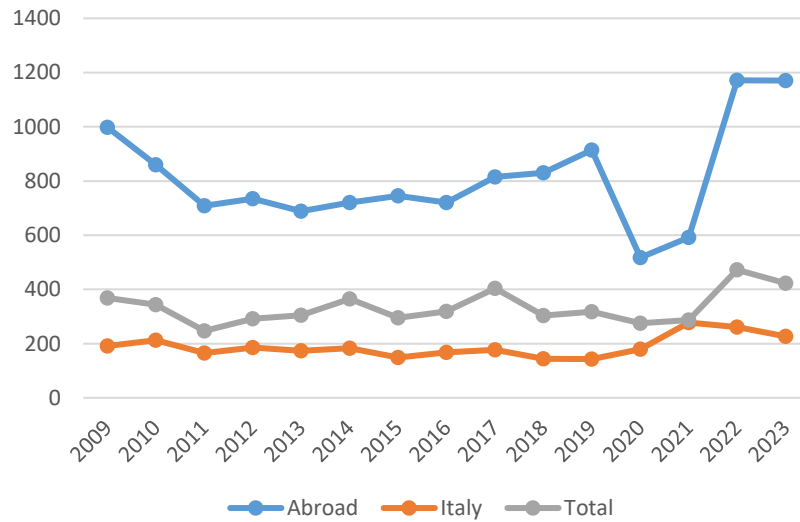
The average cost per year and destination is presented in the figure 2. Average costs show a constant trend except for the post covid time which is driven by a strong inflation.

Figure 1 – Duty travel by year and destination-

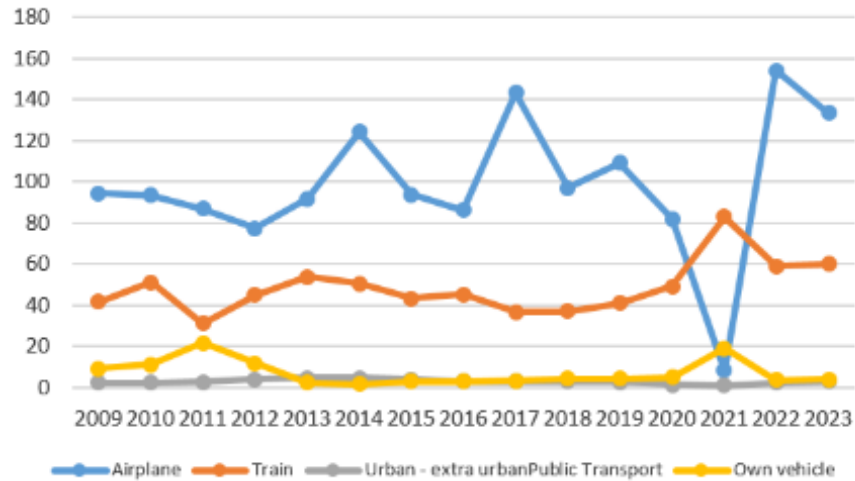


Our elaborations on duty travel data base

Figure 2 – Average cost by year and destination.



Our elaborations on duty travel data base

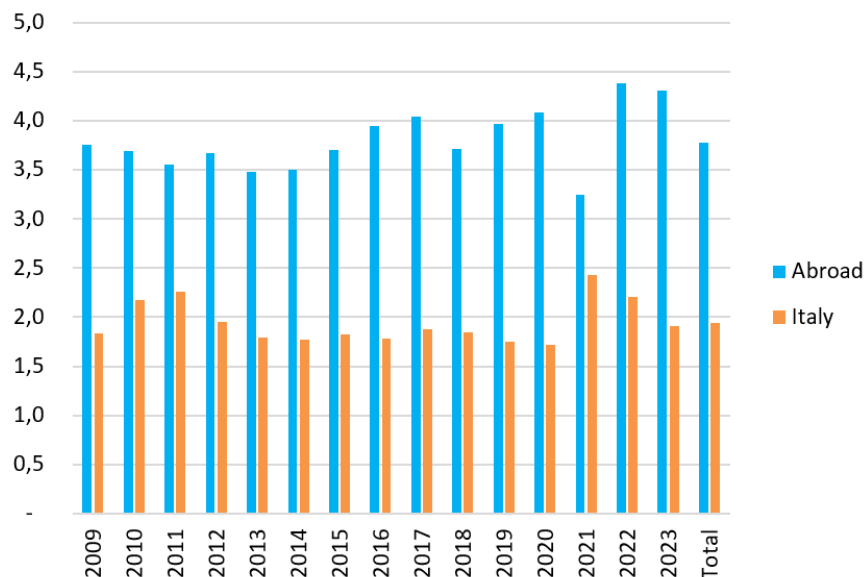
Figure 3 – Average cost by year and transport supplier.

Our elaborations on duty travel data base

In Figure 3, the average cost per year and transport supplier is presented. The average cost of extra urban transport is constant throughout the time considered. The cost of using one's personal vehicle is constant over all time except in 2021 when there is a spike due to an inflationary push which drove up fuel costs. Moreover, a consequence of the pandemic time is the use of own vehicle in order to avoid infection. The average train cost is fairly constant over the years except for 2021, which shows a slight spike due to rising energy costs. The average airplane cost has a very variable trend, plummeting in 2021 and then rising to a peak in 2022.

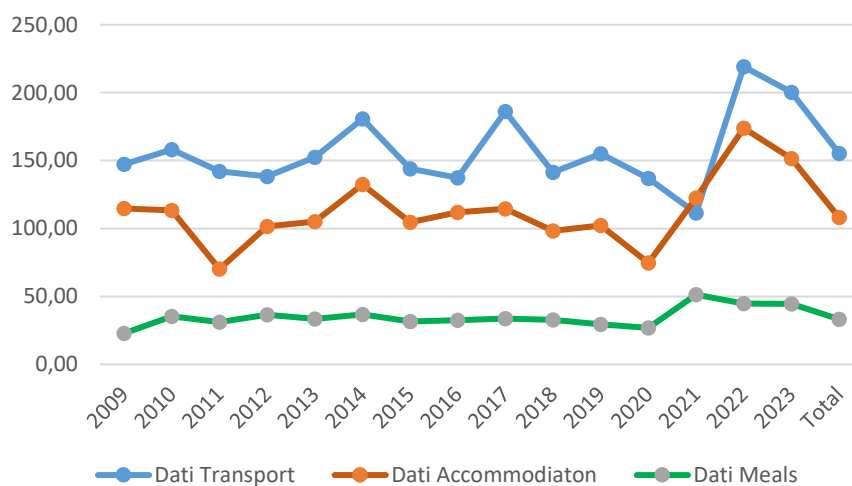
In Figure 4, we can see that the average days' duration of a mission is constant for both Italy and abroad. An exception is the value occurring during the pandemic (2021), in fact the average duration of duty travel (expressed in days) increases significantly. One possible explanation could be related to the use of own vehicle (as shown in Figure 3). The driver of the vehicle is the employee who performs the duty travel and therefore needs more recovery time. Another possible hypothesis could be the concentration of several activities in one duty travel.

Figure 4 – Average day for duty travel.



Our elaborations on duty travel data base

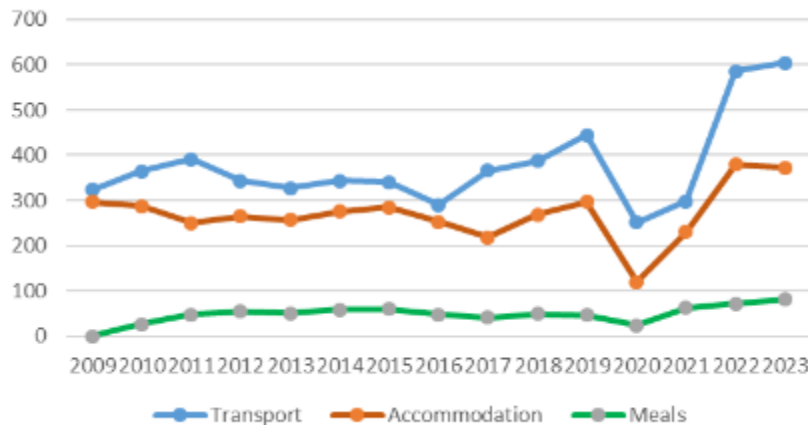
Figure 5 – Average cost by expense items (Italy).



Our elaborations on duty travel data base

In Figure 5, we can see that the average cost per item for transport and accommodation is remarkably similar over time. Interestingly, the curves of transport and accommodation engage after 2020 and instead declines after 2022, all as a result of the inflationary push and the following relapse.

Figure 6 – Average cost by expense items (Abroad).



Our elaborations on duty travel data base

In Figure 6, the average costs per item of expenditure are presented. The breakdowns for transport and accommodation show more or less the same trend and, as in Figure 5, we can clearly see the inflationary pressure of the last years.

Statistical analyses have shown us that the situation has become much more variable in recent years than at the beginning of the first decade. The pandemic certainly upset many market laws by causing inflation to rise and fall very abruptly. The analyses show us that in order to fight inflation, it is necessary to make agreements with suppliers in order to keep duty travel costs down.

4. Conclusions

In an economic phase dominated by an abundance of data and limited time to make decisions, it is important to exploit information to be competitive and generate business actions. Business Intelligence (BI) is a broad term that encompasses the strategies and technologies used by organizations to collect, analyze, and interpret data. The goal of BI is to provide businesses with insights that can be used to improve decision-making, optimize operations, and achieve strategic goals. BI can be used to

analyze a wide range of data, including administrative data. Applying Business Intelligence and Analytics increase the productivity of your institution and Strategic choices become easier.

Istat is starting a process of managerial growth in order to undertake activities for the coordination and use of strategies in order to provide technical-organizational support to the government structures of the Institute of Statistics.

This research experience must be understood as inserted within the context of great innovation that statistics are going through from the point of view of the use of administrative sources in order to represent complex realities with increasingly clear images that can assist the stakeholders in strategic choices. Statistical analysis plays a crucial role in driving innovation in management field. Overall, the use of administrative data in BI techniques is a powerful trend that allows organizations to gain deeper insights, make better decisions, and drive innovation at a lower cost.

Business Intelligence, traditionally associated with the private sector, is acquiring an increasingly central role in the public sector as well. Data analysis, in fact, can become a powerful tool for improving the efficiency, transparency and impact of administrative actions, significantly contributing to the creation of public value.

The expression "Public Value" means the multidimensional well-being (social, economic, environmental, health, institutional, scientific, etc.) generated for the benefit of citizens, businesses and stakeholders (External Public Value) by leveraging organizational health, professional, infrastructural, digital, economic-financial, Administration (Internal Public Value).

The concept of public value is constantly evolving and refers to the ability of public administrations to generate and sustain benefits for the community. In this context, Business Intelligence emerges as a strategic tool for measuring, analyzing and optimizing the impact of public policies.

The creation of external Public Value depends on the improvement of performance which, in turn, depends on the improvement of the health of the administration's resources: the creation of internal Public Value is, therefore, the prerequisite for the creation of external Public Value.

Thanks to data analysis, it is possible to identify inefficiencies and optimize internal processes, leading to resource savings.

The objective of this contribution is to use internal Istat administrative sources for exploiting statistical information to rationalize internal processes and carry out economies of scale for improving the organizational structure of the Institute.

Besides, the goal of this scientific paper has been achieved: in fact, agreements were made with transport and hotel providers to reduce mission costs and to invest the savings in other research activities..

The results of the statistical analyzes demonstrate that the number of duty travel has been constant over time, therefore allowing forecasts to be made on the future

amount. Furthermore, the trend of the last year is strongly increasing; therefore, we are back to pre-pandemic situation. The analyzes agree in designing a scenario in which the agreements already made are already creating considerable advantages in the organizational and financial management of Istat.

Istat is acting in a new direction, exploiting internal administrative sources to increase process efficiency and financial savings. the Italian Institute of Statistics, stands to gain significant advantages by combining its knowledge of BI statistical techniques with unstructured data for a modern working paradigm.

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