TOOLS OF BUSINESS INTELLIGENCE FOR MANAGING ISTAT INTERNAL PROCESSES[1]

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Abstract. In this paper, the analysis of data extracted from the Italian National Institute of Statistics (Istat) administrative database, called Urbi Smart (a structured collection of data and information managed by an organization, accessible only by its employees and used for business purposes, meaning for internal use) is used to showcase the power of the Business Intelligence for increasing the efficiency of the management system. As part of Business Intelligence process, organizations collect data from internal IT systems and external sources, prepare it for analysis, run queries against the data and create data visualizations, Business Intelligence dashboards and reports to make the analytics results available to business users for operational decision-making and strategic planning.
The information on welfare benefits selected from Istat administrative database consists of a series of variables that include employee identification data (registration number, profile, personnel plan), administrative data relating to subsidy applications and accounting data (amount submitted, amount allocated).
The goal of the analysis is to support a rational and equitable distribution of the funds allocated for employee welfare benefits. By examining patterns in subsidy requests and allocations, the BI process enables evidence-based decisions that improve transparency, optimize resource use, and strengthen the overall management system.

1. Introduction

Business Intelligence is a set of processes, technologies and tools that analyse company data (both historical and current) to generate useful information and support decision-making. It is used to better understand the current and historical performance of the company in order to identify opportunities, optimise processes and predict future scenarios, enabling more informed and strategic decision-making.

Its benefits include greater operational efficiency, improved decision-making, the identification of new market opportunities and better control over performance in the public sector. (De Vivo *et al*, 2011).

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Business Intelligence has developed to include more processes and activities to enable performance improvement, including a statistical approach.

- Data Mining: use databases, statistics, and machine learning to uncover trends in large datasets.
- Reporting: sharing data analytics with stakeholders so they can draw conclusions and make decisions.
- Performance metrics and benchmarking: compare current performance data with historical data to monitor performance against goals. Typically, this is done using custom dashboards.
- Descriptive analytics: using preliminary data analytics to understand what happened.
- Query execution: querying data with specific questions, for which Business Intelligence extracts answers from datasets.
- Statistical analysis: starting from the results of the descriptive analysis, further exploration of the data using statistics, for example in relation to how and why a certain trend has occurred.
- Data visualization: transform data analysis into visual representations, such as graphs, charts and histograms, for easier data consumption.
- Visual analytics: exploration of data through visual representations to communicate information on the fly and follow the flow of analysis.
- Data preparation: compiling various data sources, identifying their dimensions and measurements, and preparing them for data analysis. (Sharda *et al*, 2015).

In the Public Administration (PA), internal administrative sources constitute an invaluable wealth of information. However, their utilization is strongly influenced by the specific nature of the public context, particularly by the principles of legality, transparency and sound administration that govern its actions, as well as by the presence of rigorous legislation concerning privacy and data access.

The welfare benefits information selected from administrative Istat database are made up of several variables which include employee identification data (registration number, profile, staffing plan), number and submission date of subsidy applications, the expenditure incurred and disbursed, ISEE certification availability (if attached) and, for school and university contributions, the reference to the children and the schools or institutions attended. The Equivalent Economic Situation Indicator (ISEE) is a tool that allows for the measurement of the economic condition of families in the Italian Republic.

The data analysis of welfare benefits covers the years 2005-2022, so that it is possible to assess the situation before, during and after the pandemic crisis.

The first phase in building the database involved extracting the activity reports from the Istat management information system, called Urbi Smart, structured by year and contribution.

The statistical analyses used have extracted from a very large dataset of unstructured administrative data the information necessary to design strategic company policies focused on cost savings and employee welfare.

The goal is to carry out a rational distribution of the fund allocated for benefits through the analysis of subsidy requests submitted by employees.

The paper describes one example of the use of Business Intelligence in Istat. Another example is the analysis of employee business travel (Dentini *et al*., 2022; Dentini and Zeppieri, 2023), in which data purely used for administrative matters are used to obtain useful information for the management of activities. We are talking about a wealth of information to be exploited to increase the effectiveness of some internal processes of the Istat.

The paper is structured as follows. The second section includes the legislation related to corporate welfare and the analysis of the trend in subsidy applications over the years; the third section is focused on the results of the analysis conducted since the database construction; the fourth section is dedicated to the conclusions regarding the assessment of advantages and critical issues of welfare initiatives in the PA.

2. Welfare benefits in the Public Administration

Corporate welfare is the set of initiatives, goods and services made available by employers to improve the well-being of employees and their families, beyond regular remuneration. Welfare in PA, while sharing the basic objectives of corporate welfare in the private sector, presents specific characteristics linked to its public nature and the regulatory framework that governs it. Unlike the private sector, where article 51 of the TUIR (Consolidated Income Tax Act) and the National Collective Labor Agreements (CCNLs) serve as pillars, in the PA, welfare is strictly tied to the National Collective Labor Agreements (CCNLs) of the various sectors. These contracts regulate the possible forms of supplementary welfare.

Welfare services in the PA can be provided directly by the public body, offering services to its own employees (for example internal canteens, direct agreements with gyms or nurseries); or through collective agreements, where CCNLs and supplementary decentralized agreements provide for the activation of specific benefits; alternatively, through the National Institute for Social Security (INPS) - Public Employees Management, which manages a wide range of benefits and services for public employees and their families, often through competitive calls for applications.

Istat is a research institution that offers its employees a series of benefits, structured through a specific internal regulation that outlines their types, requirements and methods of provision.

The granting of social and welfare benefits for the personnel of public bodies is regulated by Presidential Decree n. 509 of 16 October 1979, which extends the aforementioned regulation to all public bodies in the Research Sector through Article 59. The CCNL 2016-2018 introduces the definition of "supplementary welfare": article 96 defines it as "a set of activities and services provided by public entities to their employees with the aim of improving their private and working life."

Each year a fund for social and welfare benefits is established, to which an overall allocation is dedicated. This allocation is determined by considering 1% of the sums recorded in the chapters of the adjusted budget for the reference year that fund the fundamental and ancillary economic treatment of personnel.

The allocation is affected by personnel movements (hirings, terminations, career progressions) that occurred in the previous year.

The establishment of general criteria for the activation of supplementary welfare plans and the rules for granting social and welfare benefits to personnel are entrusted to integrative collective bargaining between the Administration and trade unions. Istat, therefore, adopts each year (through the instrument of decentralized bargaining), these criteria for the distribution and allocation of the identified sums destined for these benefits.

Table 1 – *Welfare Fund allocation Distribution by type of benefit, 2020-2023.*

Type of benefit	2020	2021	2022	2023
School Study Support	105.000	98.157	124.249	166.797
School Scholarships	35.000	34.600	45.790	48.626
University Study Support	30.000	28.200	35.000	43.908
University Scholarships	21.000	20.000	16.000	33.525
Use of Public Transport	21.000	10.200	31.400	39.434
Nursery-Primary School*	107.628	/	96.350	27.507
Healthcare Subsidies	617.970	694.120	884.901	896.605
Summer Camps	16.600	27.400	36.000	35.427
Total Allocated Fund	**919.582**	**911.237**	**1.269.690**	**1.291.829**

Our elaborations on the Istat welfare benefits database

**The 2021 contribution for nurseries, kindergartens and primary schools was deferred to 2022 to align the annual periods with other school contributions.*

*****Due to graphic reasons, the years 2013/2019 can not be inserted in the table.*

Table 1 examines the distribution of funds in the period 2020-2023, showing significant growth since 2022. This growth was influenced, in addition to workforce population movements, by a new computation of the 1% of the sums allocated for staff remuneration.

The entire observed interval, from 2013 to 2023, highlights increases in 2014 and 2017, determined by the increase in staff. Conversely, the declines recorded between 2018 and 2021 correspond to staff terminations, without equivalent recruitment to compensate. School and university scholarships benefits have seen an improvement in the sums allocated to them starting from 2020 and, in particular, in 2023, due to political choices adopted by the Administration in order to reward meritocracy.

The use of public transport benefit was influenced by circulation limits due to the pandemic in the period 2020-2021, with progress in the subsequent two-year period that was not as incisive as in the first part of the entire observed interval. This is a result of the development of remote working organizational forms.

A particular mention is due for nursery - primary schools benefit: a decrease is observed between 2020 and 2022, due to a lower number of children of kindergarten and primary school age; however, in 2023, a change of regulation transferred the primary school benefit to school study support, resulting in the sum allocated here being much lower compared to past years.

Healthcare subsidies benefits attract the highest sum, due to the high number of requests received each year; for this reason, they have always been strengthened, with the exception of 2018, sometimes penalizing the amounts allocated to other benefits.

3. Data source and database building

The Human Resources Department of Istat has been using Urbi Smart as a management information system since 2016. The application system manages various areas of human resources, including the legal and accounting management of welfare benefits due to Istat employees who have applied for them.

To build a statistically informative database for the study of the distribution of the fund allocated for benefits, it is necessary to review the work process, divided into phases, starting from the rationalization of the information present in Urbi to select the variables to be analysed for statistical purposes.

The goal is to transform an administrative database, made up of multiple management variables, mainly used as a repository of administrative data, into a statistical database, capable of making the data classifiable and usable for statistical purposes.

The data analysis covers the years 2005-2022 and the welfare benefits analysed are the following: healthcare subsidies, use of public transport, school study support, school scholarships, university study support, university scholarships, summer camps, subsidy for nursery, kindergarten and primary school attendance.

The welfare benefits information selected from Urbi are made up of several variables which always certainly includes employee identification data (registration number, profile, staffing plan), number and submission date of subsidy applications and, finally, the expenditure incurred and disbursed.

After extracting the activity reports from Urbi information system, structured by year and ~~by~~ contribution, we created a new database for each contribution, consolidating the various annual data and then calculating the total amount disbursed per employee. In the case of school contributions (where the same employee submitted multiple applications per child), we proceeded to count the subtotals per child and then the overall totals per employee.

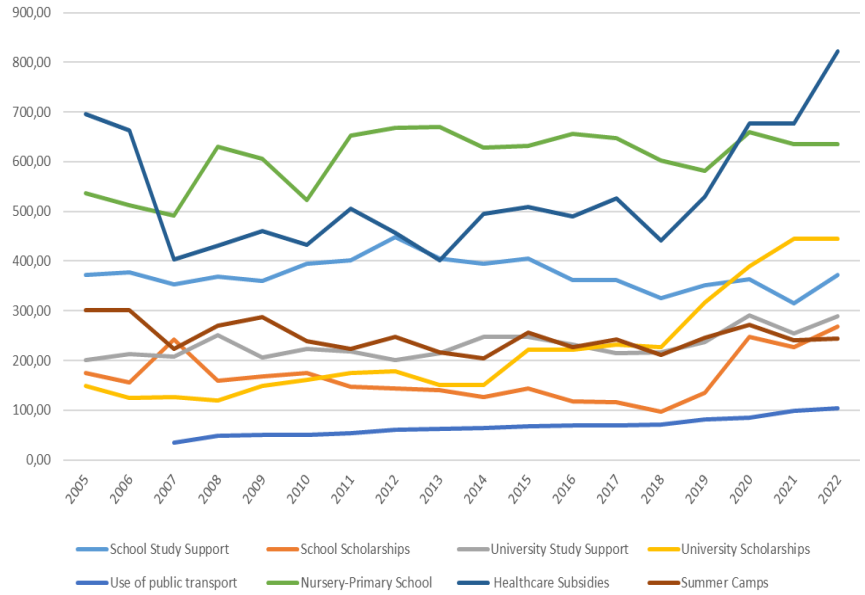
4. Analysis of the results

After building the database, we compute descriptive statistics in order to highlight particular trends. As already mentioned, the goal is to analyse the trends to make strategic decisions regarding the allocation of financial resources. We reported the extracted data for each benefit type (healthcare subsidies, school and university study support, school and university scholarships, nursery-primary school, use of public transport, summer camps) in pivot tables and then we created charts and tables for the analysis of the following measures:

- average amount disbursed per employee;
- number of applications per benefit;
- scatterplot matrix between welfare benefits and average age;
- distribution of school grades levels (first year of middle school and subsequent grades;
- school grant types (middle school degree, intermediate high school grades and high school degree);
- trends in summer stay types (daily and residential summer camps);
- transport modalities.

Figure 1 shows the average financial resources disbursed per applicant employee for each benefit. The trends are fairly constant but there are exceptions that are interesting to focus on. First of all, the healthcare subsidy which has a trend probably influenced by exogenous factors. Indeed, there are two significant moments in the time series: the economic crisis of 2007-2008 and the pandemic of 2020. As if the demand for benefits was a reflection of the times.

Figure 1 – *Average amount disbursed per employee.*



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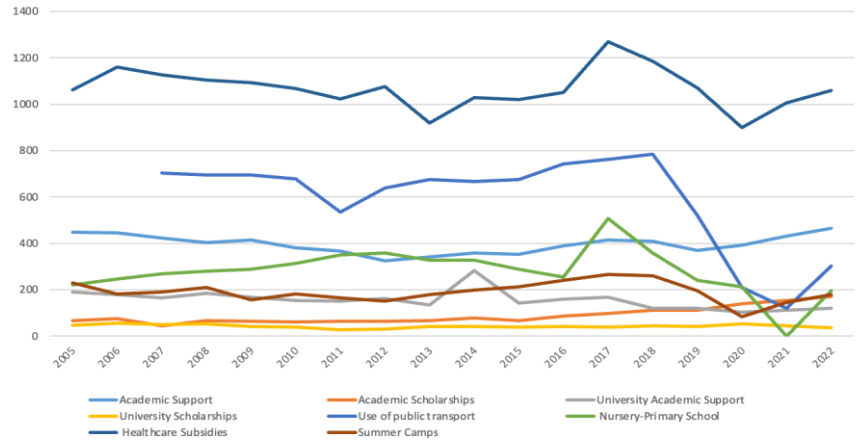
We know that the average age of Istat employees is progressively increasing and this factor is having an impact on benefit claims. The demand for university scholarships is steadily increasing, especially after 2018; while school study support is decreasing. In fact, there are no young employees; those who are there have few children, and the children of older employees are already attending university. From this Business Intelligence analysis, it is easy to see what will happen soon and where it will be most useful to allocate financial resources.

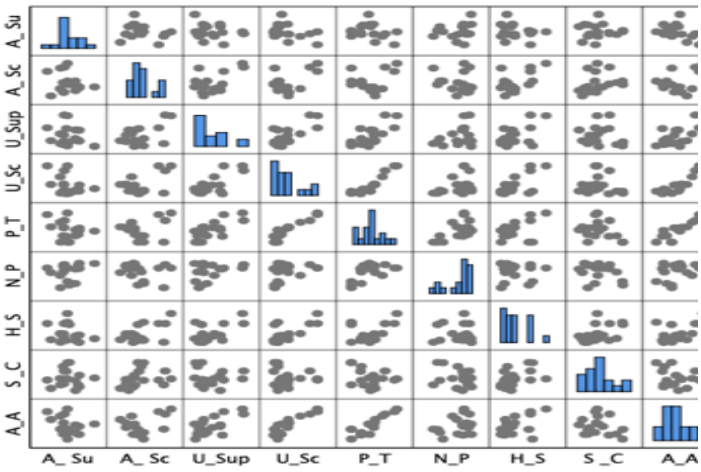
Figure 2 confirms the evidence of Figure 1 and shows very well that applications for subsidies for using public transport plummeted during the pandemic period. This shows that, with the extended use of remote working, the resources for this benefit could be reallocated to other items.

Figure 2 – *Number for application per benefit.*



Our elaborations on the Istat welfare benefits database

Figure 3 – *Scatterplot matrix between welfare benefits and average age.*



A_A	Average Age
A_Su	School Study Support
A_Sc	School Scholarships
U_Sup	University Study Support
U_Sc	University Scholarships
P_T	Use of public transport
N_P	Nursery-Primary School
H_S	Healthcare Subsidies
S_C	Summer Camps

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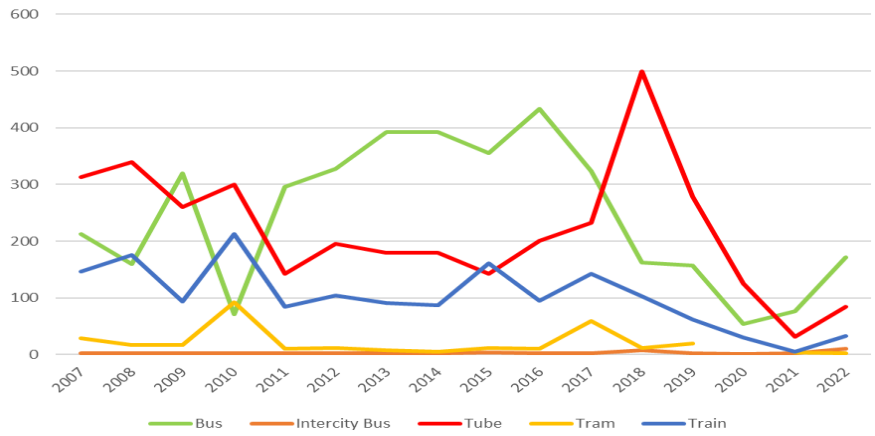
Figure 3 presents the scatterplot matrix between welfare benefits and the average age of Istat employees. A scatterplot matrix displays pairwise scatterplots for multiple variables, with each scatterplot showing the relationship between two variables. To interpret, identify the row and column of a plot to find its variable axes (row variable for y-axis, column variable for x-axis). Diagonal plots show individual

variable distributions, often as histograms. Average age is positively correlated with healthcare benefits, public transport usage and university benefits. In addition, mean age is negatively correlated with summer camps and primary and secondary school subsidies.

Therefore, the results confirm the theory that the rising average age is a parameter that influences the trend of welfare benefit applications and the allocation of welfare benefits in the coming years; unless public competitions are instituted to encourage the entry of younger staff who obviously need different support.

By analysing selected modalities in the Urbi database related to specific applications, it was possible to examine how the working conditions of the Institute's employees changed over the period 2005–2022.

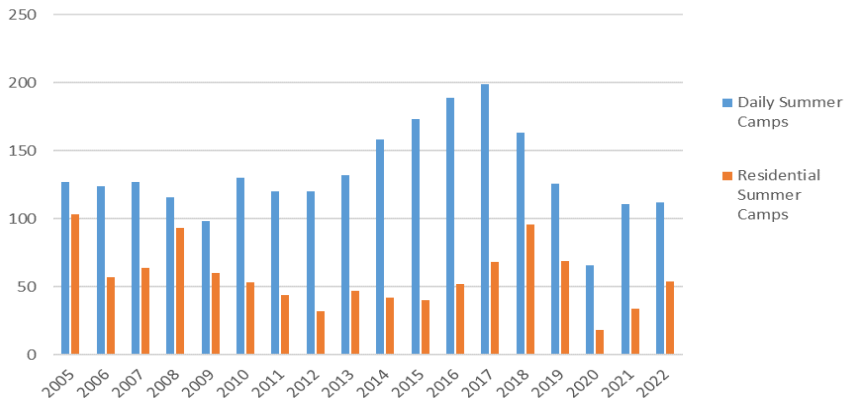
Figure 4 – *Transport modalities (2007-2022).*



Our elaborations on the Istat welfare benefits database

Figure 4 depicts the different means of transport used by Istat employees to travel between home and work. The welfare contribution for the use of public transport has been introduced in the benefits fund since 2007. In recent years, the most frequently used means of transport have been buses and tube. The analysis of the data allows interaction with the mobility manager in order to conclude agreements with the companies providing transport services. There is evidence of a substantial drop in applications in the Covid 19 period, a trend confirmed precisely by the limitation of travel.

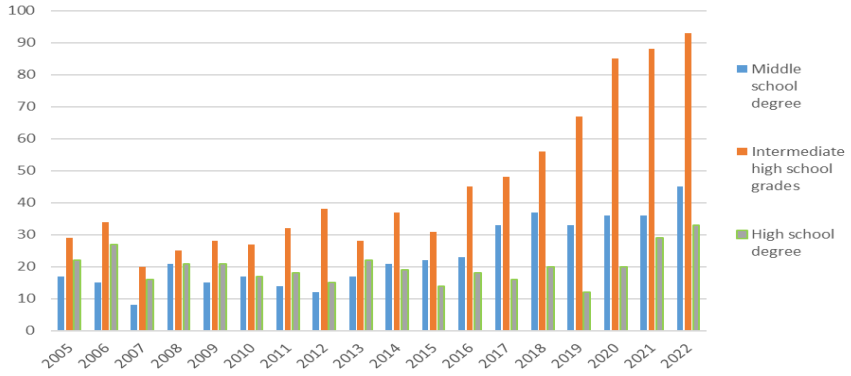
Figure 5 – *Trends in summer stay types (2005-2022).*



Our elaborations on the Istat welfare benefits database

Figure 5 analyses the trend of summer stay types (daily and residential summer camps); there is an increase in day-trips until 2017, then they begin to decrease, which became more pronounced during the pandemic.

Figure 6 – *School grant types (2005-2022).*



Our elaborations on the Istat welfare benefits database

In Figure 6, school grants are analysed. Scholarships are distributed at the end of the study cycle and for intermediate classes. Since 2016, applications for school grants for intermediate levels have increased and since 2020, grants for the last year

of upper classes will also increase, which suggests that applications for university grants and scholarships will increase in the coming years.

5. Conclusion

The PA is today engaged in a renewal process that focuses on the internal efficiency of each individual administration, on greater transparency and on more accessible, flexible and timely services, for facilitating the relationship between the public service and citizen.

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.

Resource reallocation is an economic concept that refers to the reuse or redistribution of productive assets (such as capital, labour, time, technology) from one activity or sector to another in order to optimise efficiency and productivity.

The distribution of funds for the respective types of welfare benefits provided by Istat to its employees may be modified based on data analysis. In particular, with the rising average age of employees, applications for nursery school have dropped, while those for university support have risen. In such a case, a different allocation of economic resources would be appropriate, considering the changing needs of employees.

Welfare plays a crucial role in PA, as it contributes to greater personal and family well-being, reducing stress and improving work-life balance. Benefits, being often tax-free or contribution-free, allow employees to access services and goods with a higher net value.

A public authority that invests in the welfare of its employees shows a more modern, responsible and people-oriented image. Welfare is a concrete way to show care for employees, reinforcing a sense of belonging and gratitude. A competitive welfare offer can make PA more attractive to professionals, helping to retain internal skills (Yamamoto, 2011).

Despite clear advantages, welfare in PA has faced limitations in the past due to budgetary constraints and regulatory complexities. However, recent interpretations of the Court of Auditors on the expenditure ceiling are opening new perspectives, allowing administrations to invest more in these measures.

It is crucial that public administrations, also through supplementary bargaining, explore and implement welfare plans that respond effectively to the specific needs of their employees, making the most of the opportunities offered by the legislation and available funds.

In conclusion, the analyses developed show that the inexorable ageing of Istat employees combined with remote working must push towards a new allocation of welfare benefit funds. In the future, benefit resources need to be concentrated on higher levels of education (university) and medical expenses, rather than on schooling (from nursery to high school) and public transport. This scenario can only change if new young employees are recruited through public competitions.

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