How We Did It

Identifying Opportunities for Operational Efficiency in Jackson, MS

Executive Summary

Like so many municipalities across the country, the City of Jackson, MS faces significant fiscal and budgetary constraints, so building an evidence base for operational efficiencies is a key service delivery challenge. The Center for Government Excellence (GovEx) at Johns Hopkins University collaborated with Jackson to build an intelligence layer and interactive analytics tool: ***Compared to Jackson***. The tool and underlying data is helping the city evaluate the size and relative proportion of its budget and workforce compared to peer cities - identifying opportunities to align Jackson's service delivery with budget expenditures common in other comparable places.

To launch ***Compared to Jackson***, GovEx conducted an analysis of 286 mid-sized U.S. cities, identifying a cluster of five cities to which Jackson is most mathematically similar: Akron, Baton Rouge, Fort Wayne, Montgomery, and Shreveport. Next, GovEx collected, normalized, analyzed and visualized budget and personnel data from this cohort of cities. The result revealed insights about where Jackson may find operational efficiencies in its budget.

Key Findings:

- ***Yes, Jackson spends more per capita than its peers:*** Jackson spends more per capita than four out of five cohort cities. In fact, the only city spending more per capita is Baton Rouge, which also services the surrounding parish/county.
- ***No, Personnel spending is not driving the difference:*** Personnel is not the major driver of Jackson's comparatively high spending. Jackson has a smaller and less expensive workforce than most of its peer cities. The average employee earns between $20-$30k, which is less than comparable jurisdictions, but the average male employee earns more in salary and works 1.3 more hours than the average female employee. Overtime spending is concentrated in emergency services and human resources departments, which also has disproportionately high operational spending.
- ***Operations is the real cost driver in Jackson, especially in public works:*** The biggest difference driver for Jackson is the amount it spends on operations, particularly in public works (water/sewer, streets, facilities), and in human resources. Jackson's spending on water/sewer alone totaled more than the entire public works spending of all cities in the cohort.

Background & Context

During its What Works Cities engagement in 2015, the City of Jackson, MS demonstrated a willingness to embed data-driven decision making into government operations, and they followed through on that commitment with demonstrable action. For example, Jackson's newly created Office of Performance and Innovation worked with the Center for Government Excellence (GovEx) at Johns Hopkins University to implement a performance analytics system that the city will use to track progress towards strategic goals and improve departmental decision making. The Office also developed a plan to share Jackson's progress towards these goals with city residents in a performance dashboard and launched their first Open Data Portal. By sharing data with the public, the city is making successes and challenges more visible to residents, enhancing the city's ability to make compelling arguments about which programs to support.

In recent years, Jackson has faced numerous budget shortfalls and uncertainty about the efficacy of it's internal staffing practices. After the successful completion of open data and performance management scopes of work, Jackson was interested in leveraging the What Works Cities resources once again - focused on projects that contribute to Jackson's bottom line: gaining operational efficiency and improving the collection and allocation of scarce resources.

To that end, GovEx, its partners, and the City of Jackson held discussions to determine the potential for an advanced analytics scope of work. On April 21, 2016, the leadership in Jackson signed a Memorandum of Understanding committing themselves to an additional engagement with GovEx, an Analytics Kickstart.

Summary of Analytics Kickstarts

Using support from Bloomberg Philanthropies, the Johns Hopkins University Center for Government Excellence ("GovEx") launched the GovEx Analytics Kickstart Program which includes three primary areas of work:

- **Direct Project Support:** Providing project-specific assistance on 1-3 projects in up to five (5) What Work Cities.
- **Guidance:** Targeted guidance to those cities interested in creating a sustainable analytics capacity with their administration.
- **Replication Promotion:** Promoting the replication of underlying fundamentals which enable the success of risk identification projects like those featured here.

GovEx uses the Analytics Kickstart Program to demonstrate the value and feasibility of an analytics program. This program provides genuine improvements in government service delivery via data analytics, as well as building the foundation for a politically-resilient data and evidence

driven decision support infrastructure. The selection of cities contemplates readiness based on the maturity of a city's current use of data and evidence. To ensure successful deployments, all Kickstart cities must demonstrate their readiness and commitment from a political, cultural, legal, & technological standpoint. However, it is normal that participating cities have not expressly addressed these requirements during the initial phase of the deployment. Thus, it is sufficient to determine that (1) leadership has committed to the program, and (2) data is available to be leveraged.

Identifying the Right Challenges and Opportunities

To identify the right challenges in Jackson, the GovEx team spent several months doing background research on the strengths and challenges in the city. This background research involved reviewing news clips, identifying open-source data, and brainstorming the feasibility of projects relevant to pressing issues.

Before arriving on the ground in Jackson, the GovEx team conducted preparatory calls with city staff, getting a sense for project opportunities that would be supported, and driven, by city leadership. On May 16th and 17th, 2016, GovEx conducted a site visit with several members of the city's leadership team to discuss further opportunities to help build decision-support capacity. The discussions included Justin Bruce, Jackie Anderson Woods, Norby Harris, Frederick Wilson and Mayor Tony Yarber from the City of Jackson, and Sheila Dugan, Carter Hewgley, and Mike Flowers from GovEx/WWC. As a result of this legwork, GovEX and the City of Jackson landed on a mutually agreeable scope and collaborative working agreement.

During multiple conversations with the city, GovEx came to appreciate the city's significant fiscal and budgetary challenges. Reducing costs through greater operational efficiency was therefore a key service delivery challenge for the city. Jackson wanted to build its capacity to identify those opportunities, make decisions based on that intelligence, and communicate the rationale behind those decisions in a manner that increases public understanding and support. Therefore, to help the city gain operational efficiency, GovEx decided to collaborate with Jackson to build an intelligence layer and interactive analytics tool: ***Compared to Jackson***. The tool and underlying data would help the city evaluate the size and relative proportion of its budget and workforce compared to peer cities - identifying opportunities to align Jackson's service delivery with budget expenditures common in other comparable places.

Executing the ***Compared to Jackson*** Project included these major steps:

- Building Trusted Relationships with Stakeholders
- Finding Jackson's Comparison Cohort
- Accessing & Managing the Data
- Choosing an Analytical Methodology
- Leveraging Technology
- Understanding the Work & Getting Feedback

- Training the End Users

Building Trusted Relationships with Stakeholders

Analysis, if done well, requires relationships. The person mining the data for insights must begin with a foundational understanding of the context in which the data was created - which includes the people, culture, norms and business rules associated with service delivery - all best understood through an ongoing dialogue with those closest to the work and at critical programmatic decision points. At GovEx, we prioritize building strong trusted relationships with government partners as we support their efforts to improve services for residents.

GovEx invested a full year working with Jackson's team on two separate, but related, scopes of work before beginning this advanced effort. During the preceding year, two members of the GovEx team had conducted in-person site visits to Jackson, and held countless phone calls coordinating joint efforts to open data and improve performance management practices in the city. Those prior scopes of work helped GovEx build relationships with city staff that withstood the test of time and strengthened GovEx's ability to understand the city's needs, habits, and working style.

When it became clear the ***Compared to Jackson*** project would involve budget and human capital data, the team leveraged existing relationships with the Departments of Administration and Personnel Management to get access to the information and expertise needed to execute the project.

Finding Jackson's Cohort

Comparing Jackson's budget and personnel ratios to other jurisdictions sounds simple, but there are hundreds of cities to choose from and no data standards for municipal government budgets. Therefore, GovEx relied on the U.S. Census Bureau for standardized demographic, economic, and geographic data to identify a comparison cohort of cities similar to Jackson.

The U.S. Census Bureau publishes three products which were particularly useful for identifying the cohort for the ***Compared to Jackson*** project:

1. The American Community Survey (ACS) is the second largest (and more detailed) of the surveys conducted by the Census Bureau. Unlike the regular census, which asks fairly high-level questions of the entire population once every ten years, the ACS asks more detailed questions in a monthly statistical survey of a sample population. It is used by local officials, community members, researchers, and businesses to understand trends in ancestry, educational attainment, income, language proficiency, migration, disability, employment, and housing characteristics for places within the United States.

2. The State & Local Government Finance survey is an annual survey of municipal governments about their revenues, expenditures, debt, and assets (cash and security holdings).

GovEx conducted an analysis of 286 mid-sized U.S. cities to identify a cluster of cities to which Jackson is most mathematically similar on eight demographic variables: 2013 population, median income, land area, population density, geographic region, state capital status, percentage of population nonwhite, and percentage of population in poverty. Using these variables, GovEx used clustering methods[1] to identify cities most similar to Jackson. Clustering algorithms group cities into clusters based on how similar their variables are to each other. This allows us to identify cities that are appropriate to compare to Jackson. Based on the clustering analysis, the following cities were consistently grouped very close to Jackson:

- Akron, OH
- Baton Rouge, LA[2]
- Fort Wayne, IN
- Montgomery, AL
- Shreveport, LA

Accessing the Data

Collecting consistent budget and personnel data from this cohort of cities was one of the biggest challenges the team faced when building ***Compared to Jackson.*** Although the U.S. Census has a wealth of information about these cities, Jackson would need more detailed, program-level information about other cities to provide meaningful comparisons to decision makers. Therefore, the GovEx team began collecting budget data from the public websites of each jurisdiction, all described in the table below.

[1] For more on how clustering analysis works, see the section called *Analytical Methodology: Analyzing the Cities.*

[2] *The City of Baton Rouge, while similar to the other cities in this cohort, includes both city and parish spending.*

City	Document	Year(s)	Link
Jackson	Budget	2015	http://www.jacksonms.gov/DocumentCenter/View/2693
Akron	Budget	2015	http://www.akronohio.gov/cms/site/05c6ac81a4ae26d4/index.html
Baton Rouge	Budget	2016	https://transparencyapps.demo.socrata.com/dataset/Baton-Rouge-Operating-Budget/tnf4-wxj6
Montgomery	Budget	2015	http://www.montgomeryal.gov/city-government/mayor-and-city-council/mayor-s-office/2015-budget
Shreveport	Budget	2015	http://www.shreveportla.gov/index.aspx?NID=199
Fort Wayne	Budget	2015	http://www.cityoffortwayne.org/images/stories/2015_Budget/2015_CITY_OF_FORT_WAYNE_BUDGET_BOOK_smartgov.pdf

In many cases, the budget documents in the table above are PDF files of published budgets, which are not easily transferred into analysis tools. Relying solely on PDF documents requires manually copying and pasting data into a common format - a method that is both time consuming and error prone. To avoid these problems, the team used optical character recognition features in Adobe Acrobat to transform the budgets into tabular data, which was then compiled into a master spreadsheet.

Since government expenses on personnel are a function of both volume and rate, GovEx also needed access to data about how Jackson's personnel is compensated. To that end, GovEx worked with the City of Jackson to gain access to two additional, more sensitive, data files, which shed light on the current workforce and most recent hires in Jackson:

- Current Employee Report
- New Hire by Date Report

These encrypted files were stored and analyzed separately from the web-enabled database and comparisons with other cities, in accordance with the GovEx Information Security Policy.

Understanding the Work (and the data)

Throughout the project, GovEx held weekly calls with the project champion in the City of Jackson. These calls ensure alignment on project goals and keep everyone informed of existing barriers. Barriers can include gaining access to data, answering questions about existing data, and logistical planning for demonstrations and trainings.

Since this project involves government budgeting, which many members of the GovEx team are familiar with, the project did not require the GovEx team to develop subject matter expertise in a new program or service. Therefore, no site visits or “ride-alongs” were necessary.

However, in the spirit of agile development, GovEx delivered a prototype of ***Compared to Jackson*** to the city project champions on August 17th. Based on their feedback, the tool was revised and updated for completion and final delivery.

Analytical Methodology

Compared to Jackson is comprised of three analytical components:

1. Analyzing the Cities
2. Analyzing the Cohort
3. Analyzing Jackson

Analyzing the Cities

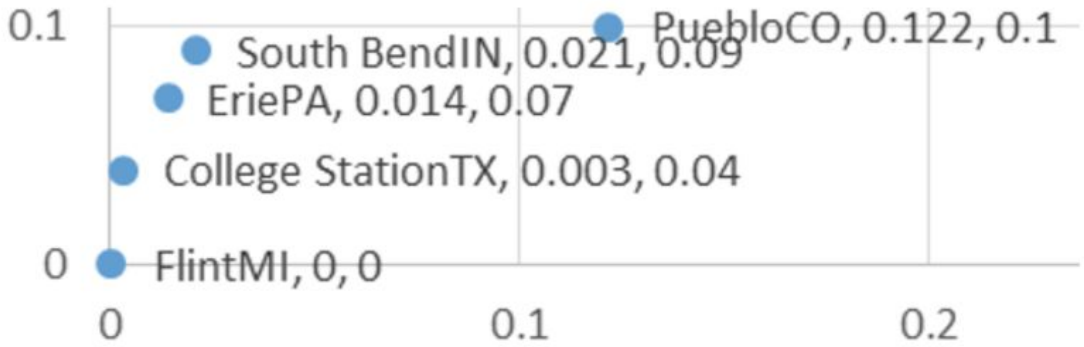
As mentioned previously, using data sources from the U.S. Census, GovEx conducted an analysis of 286 U.S. cities with populations from 100,000 to 1,000,000. This range limits the analysis to what GovEx considers “mid-sized cities.” The analysis explored the relationship between a mid-sized city’s demographic, economic, and geographic factors using exploratory data analysis and clustering algorithms. In essence, GovEx analyzed the features of the cities and represented them mathematically as numeric values. For example, we describe demographics using the feature of non-white population, expressed as a number ranging from 0 to 1.

The features used in this analysis included:

- 2013 population,
- median income,
- land area,
- population density,
- geographic region,
- state capital status,
- percentage of population nonwhite; and,

- percentage of population in poverty.

The next step involves plotting each city as a point on a coordinate grid, then calculating the "distance" between one city's values and all the other cities' values. The following graph illustrates the concept of plotting cities on a graph.



With these coordinates, we can calculate the distance between cities using the following distance equation:

- South Bend, IN and Erie, PA
  - √((0.021-0.014)^2 + (0.09-0.07)^2))≈0.021
- Erie, PA and College Station, TX
  - √((0.014-0.003)^2 + (0.07-0.04)^2))≈0.032

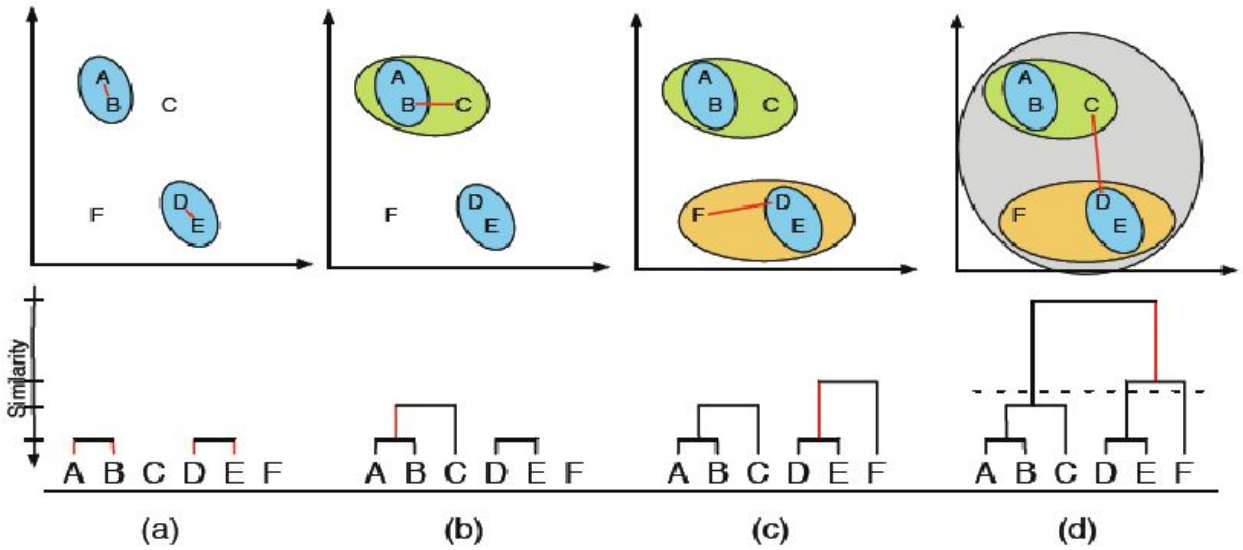
In this example, South Bend and Erie are closer together than Erie is to College Station.[3]

To understand how cluster analysis places the 286 cities into similar groups, consider the example below of six cities in six separate clusters. We combine the clusters by grouping pairs that are close to each other using an equation similar to the one explained above.

For example, *A* and *B* are closer than *A* and *B*, so the algorithm puts *B* and *C* into a new cluster *BC*. This grouping process is repeated until all the cities are in a single cluster. This "bottom up" technique is called "agglomerative clustering."

[3] This example is adapted from the Statistics and Modeling With City Data training module by Richard Dunks.

Example: Hierarchical Agglomerative Clustering



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https://www.researchgate.net/figure/273456906_fig3_Figure-4-Example-of-hierarchical-clustering-clusters-are-consecutively-merged-with-the

We used this clustering algorithm to group the list of 286 cities, and identified a group of six cities that are consistently grouped very close to Jackson:

- Baton Rouge, LA[5]
- Montgomery, AL
- Shreveport, LA
- Fort Wayne, IN
- Akron, OH

Analyzing the Cohort

With a comparable cohort identified, the GovEx team began collecting data on the budget expenditures and personnel in each city. All data was compiled in a Google Sheet for simultaneous multi-user access. Because the data would be visualized using Tableau, the team knew the data would need to be *flat* and *granular*. This meant putting as much as possible in one worksheet and striving for the lowest possible level of reporting (i.e. line item expenditures). Therefore, the data was re-structured into a machine-readable format, with each value listed as a separate field, and clear column headers easy to export as comma separated values (CSV).

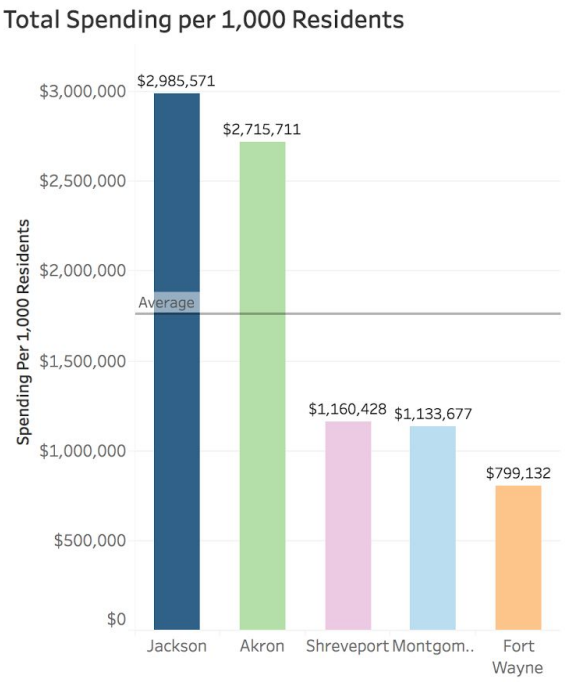
Field Name	Field Description
City	Name of the city
Department	Name of the Department
Program	Name of the Program within the Department
Sub-Program	Name of the Program within a Program
Dept/Program?	Flag for whether this row is Department level or Program level, since at least one city's budget contained both aggregated and disaggregated budget information. This flag can be used to filter out department-level information when comparing programs and should be filtered for to avoid duplication.
Category	Category of Spending - Detail (e.g. rental equipment, benefits, etc)
Spending Category Tag	Category of Spending - Summary (e.g. Personnel, Operating, Capital, etc)
Year	Fiscal Year
Budget Cycle	Which type of spending is being reported: Budget, Actual, Approved
Spending	Expenditures ($)
Fund Name	The Actual Name of the Fund (e.g. General Fund, Larry Waters Memorial Fund)
FTE Count	The number of Full Time Equivalents associated with that program or department
Department Tag	GovEx's tagging of department categories for comparison between cities (Police, Fire, Health, Human Services, etc)

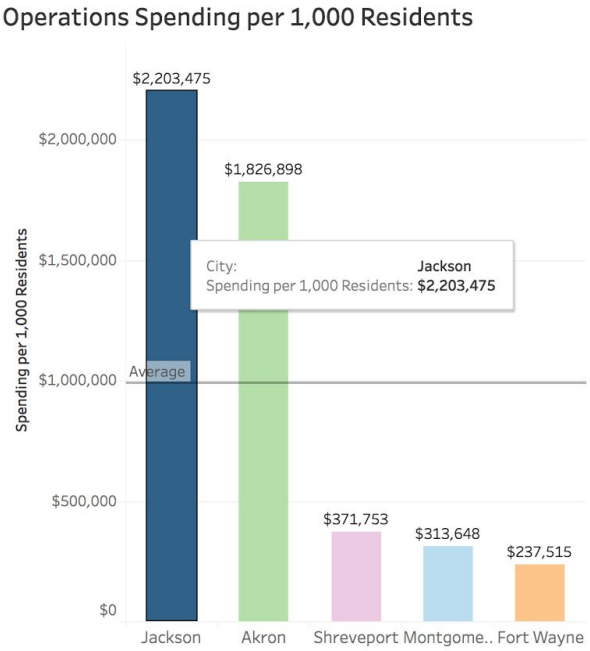
[5] The City of Baton Rouge, while similar to the other cities in this cohort, includes both city and parish spending.

Program Tag	GovEx's tagging of program categories for comparison between cities (Legal, Permits, Streets, etc.)

With a flat, granular, normalized data, the team began constructing data visualizations based on a user-driven storyboard. The graphs on each page are designed to show Jackson's spending characteristics in relation to the cohort cities. After viewing city-wide information, the user is shown city spending by department and program.

The GovEx team opted to keep the analysis simple, using simple bar charts to display the cities' expenditures and FTE counts compared to Jackson's. For those interested in learning more about the cohort, the team chose to use a tabular view comparing the demographics of each city to one another. All data and analysis scripts from this project are available on the [GovEx GitHub repository] for sharing and collaboration.





Analyzing Jackson

Separately from the cohort analysis, GovEx also analyzed Jackson's current workforce to identify where Jackson is putting the bulk of it personnel resources. This analysis looked at both volume and cost, because both are critical to identifying opportunities to gain operational efficiencies.

Using Microsoft Excel and Tableau, GovEx analyzed the distribution of employees across programs and compared that distribution to compensation. Such analysis reveals insights common to many government organizations. Jackson is no exception. Knowing where an organization is being squeezed from both a cost and volume perspective is critical to fully understanding budget drivers.

The team also looked at differences in compensation based on gender and race, to see if there were any underlying equity issues to be addressed.

Technology

During the planning and development of Compared to Jackson, the GovEx team used several forms of technology which contributed to the project's success, each listed below.

Tool Name	Tool Type	How it was Used
Excel	Spreadsheet/Database	Analysis of Jackson Workforce, and Data Collection from select cities
CSV	Spreadsheet/Database	Exporting data from open data portals and connecting data to Tableau
R/R Studio	Statistics & Data Visualization Package	Clustering Analysis to identify Jackson's cohort cities
Google Docs	Shared Documents	Project Documentation
Google Sheets	Shared Spreadsheet/Database	Data collection for budget and FTE data from cities
Tableau	Interactive Data Visualization Software	Building the client-facing Compared to Jackson interactive data visualizations
Adobe Acrobat	PDF viewer and converter	Convert PDF files into spreadsheet files using built-in conversion features

Key Findings

Over the course of this project, the GovEx team learned a tremendous amount about Jackson and its cohort cities. The notes below are highlights of the key findings from the questions posed in the collaborative agreement which we were (and were not) able to answer

1. **What did we learn by comparing Jackson's expenditures and personnel to other members of the cohort? What are the true cost drivers?**
    a. Jackson had the highest budget per capita in comparison to the cohort cities.
    b. Jackson spends the second least per full time employee.
    c. Jackson spends more than the average in a number of department and program areas.
        i. The largest program category spending was water and sewer in public works.

2. **What did we learn by looking at the distribution of Jackson's workforce across programs and compensation schedules?**
    a. The workforce consists of 782 women and 1,263 men.
    b. On average, men worked 1.305 hours more than women:
    c. Overtime pay is concentrated in two departments:
        i. Emergency Services Division averaging 11.987 daily hours.
        ii. Human Resources Division averaging 9.5 daily hours.
    d. Most annual rates are between the $20K - $30K range. For workers paid on a biweekly schedule, men made $2,914 more than women.
    e. For workers paid on a weekly schedule, men made $7,815 more than women.

3. **What did we learn about Jackson's (or another city's) data practices as we put this project together?**
    a. Cities do not publish budget data in a consistent format.
        i. Each city has unique definitions of budget cycles, department spending, program spending, line item descriptions, and fund categories.
    b. Budget data is not usually available in machine-readable formats.
        i. This makes large-scale cross-city analysis difficult.

Unanswered Questions

The biggest unanswered question from this project relates to the fact that Jackson spends so much on water and sewer services, but only one other cohort member listed those services explicitly. Normalizing municipal budgets is difficult. There are few, if any, data standards. Jurisdictional boundaries differ from place to place, and the services are not perfect apples to apples comparisons. So the unanswered questions is: does Jackson's water and sewer spending look abnormal because it is, because the data is missing from the other cities, or because the water/sewer services in these cities are simply not comparable. As a next step, Jackson should consider identifying jurisdictions which directly deliver water/sewer services and compare its spending to those jurisdictions.

Future Implications & Replication Potential

Compared to Jackson is a tremendously powerful tool, both in principle and reality. On its face, the tool puts the power of comparative information into the busy hands of civil servants who don't have time to collect and analyze data from seven mid-sized American cities. The budgeting process moves quickly and budgetors and budget examiners alike will benefit from seeing how Jackson stacks up to its peer cities.

On principle, ***Compared to Jackson*** is a data-driven approach to understanding resource allocations, which is a decision process too frequently devoid of facts. Jackson residents will hopefully see that their city's leadership engaged an objective university to identify a mathematically valid cohort of comparator cities to reveal a factual laydown of resources. But more importantly, GovEx is teaching Jackson how to do this type of analysis on its own, so improvements can be made and replication into future budget cycles is more likely.

To maximize replication potential, GovEx has conducted this project using tools that are largely available at little or no cost to the city (e.g. Excel, Google Sheets). Data from the U.S. Census is publicly available, as is data about city budgets - the limiting factor for some city budgets is the format, since many of them are published in PDF only. However, the advent of open data will make this increasingly less difficult over time. The algorithm used to conduct the clustering analysis is open source, and was run in R/RStudio, which is also open source. The only tool with a price tag is Tableau Professional Desktop, which GovEx chose to use because the price tag for a single-user license is within an acceptable range for most mid-sized American cities, and because the price tag includes access to Tableau Public, which is how the data

visualization was rendered on the web. However, Tableau was only used for the interactive data visualization, which is not required to mine the underlying budgeting data for insights.

To ensure the City of Jackson is prepared to leverage this tool, improve it, and replicate it during future budgeting cycles, GovEx conducted a multi-day on site training to city staff interested in using the tool and analyzing the underlying data. GovEx transferred the data, the findings, and the methodology to the city in a mutually agreeable mechanism. There is no aspect of this project that relies on GovEx for continued maintenance or support, but we remain partners in the city's ongoing effort to use data and evidence to improve operations.

Conclusion

GovEx collaborated with Jackson to build an intelligence layer and interactive analytics tool: ***Compared to Jackson***. The tool and underlying data is helping the city evaluate the size and relative proportion of its budget and workforce compared to peer cities - identifying opportunities to align Jackson's service delivery with budget expenditures common in other comparable places. What's the result?

Jackson spends more per capita than its peers. But it is operations, not personnel, that drives the difference. Jackson has a smaller and less expensive workforce than most of its peer cities. But operational spending on public works (water/sewer, streets, facilities), and in human resources make Jackson an outlier among all cities in the cohort. As a next step, Jackson should consider identifying jurisdictions which directly deliver water/sewer services and compare its spending to those jurisdictions.

Jackson has the data, the methodology, and the training to replicate and/or improve on this project. There is no aspect of this project that relies on GovEx for continued maintenance or support, but we remain partners in the city's ongoing effort to use data and evidence to improve operations.

Appendix A - How Tagging Worked

To allow for comparisons between cities, GovEx created tags for departments and programs to package each line item into a generalizable category across cities. The methodology for that tagging is documented below:

Department Tag	Program Tag(s)
Administration	Administration General Executive Human Resources Legislative Public Affairs Legal Clerk/Records
Court	Family Court Juvenile Services Municipal Court Public Defender
Economic Development	Economic Development General
Finance	Finance General Budget Controller Debt Service Insurance Miscellaneous Purchasing Retirement Transfers
Health & Human Services	Education Health (includes Animal Control, Coroner) Housing Human Services
Information Technology	IT General Telecommunications
Other	Audit/Investigations

	Library Miscellaneous Voting
Parks & Recreation	Parks and Recreation General Convention Center Events Museum Zoo
Planning	Planning General Historic Preservation Permits Zoning
Public Safety	Public Safety General Code Enforcement Emergency Management Police Fire EMS
Public Works	Public Works General Constituent Services/311 Engineering Environmental Services Facilities Fleet Streets Waste Management Water/Sewer
Transportation	Transportation General Airport Parking Traffic