2020

Investigating the Influence of a Web Based Logistics Tool on the Effectiveness of Operations for the Center of Innovation for Logistics of Georgia

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Investigating the Influence of a Web Based Logistics Tool on the Effectiveness of Operations for the Center of Innovation for Logistics of Georgia

An Honors Thesis submitted in partial fulfillment of the requirements for an Honors in Enterprise Systems and Analysis & Logistics and Supply Chain Management

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Abstract

Research suggests a correlation between advancements in logistics infrastructure and the development rate of regional economies. Some states have identified this correlation and have taken steps to create specialized entities aimed at catalyzing the growth of logistics within their state. In the state of Georgia, the Center of Innovation for Logistics is the entity responsible for coordinating logistic development activities. As part of their responsibilities, they are tasked with fulfilling information requests regarding logistics infrastructure availability throughout the state. However, the system being used to process these requests is antiquated and extremely inefficient. In an attempt to ameliorate this process, a web-based data tool that aggregates all necessary data into one place and provides a simple user interface to query the database for specific information was introduced. This tool greatly improved the time required to process reports and added a degree of transparency in reporting across the organization.

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April 2020

Logistics and Supply Chain Management

University Honors Program

Georgia Southern University

Acknowledgments

This thesis is the culmination of a four-year academic journey that would not have been possible without the help of a group of select individuals that gave me the tools, resources and experiences that I would need to be successful. The first and foremost members of this group are my parents. Ever since I was a child my parents have instilled a sense of tenacity in me, to never leave a task unfinished. As well as to never halfway complete a task, "anything worth the initial endeavor is worth your whole effort". These lessons have been worth their weight in gold and I know they will continue to serve me well for the rest of my life. Thank you for believing in me.

To Dr. Marc Scott and Dr. Gerard Burke, I learned more in your classes than I had throughout the entirety of the rest of my college career. You taught me skills outside the context of the curriculum that not only help me grow as a student but as a person. The unique experiences you exposed me to will persist and continue to influence me for far longer than any classroom lecture. I truly believe that you both help me change the trajectory of my life for the better and I am eternally grateful.

To my long-standing group of friends: Victor, Keegan, Daniel, Nick, Michael, and Andrew I could not have hoped for a better group of men to grow up with. As "Iron sharpens iron, so one man sharpens another." and I find myself blessed to have had the opportunity to learn and to keep learning from each of you. I could not have accomplished half of what I have so far without all of your support, and I am deeply grateful for that. You all are the definition of true friends. Finally, a special thank you to Brianna for your help and counseling in the creation of this thesis.

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1. Introduction

Economic development is the high-level name given to activities that support the stimulus and growth of industries and individuals in a given area. Economic development can be split into three major categories: policies aimed at sustainable economic growth, policies aimed at infrastructure development and maintenance, and policies aimed at the creation, and growth of businesses (Swati Ghosh 2015). These policies aim to ameliorate the economic well-being of communities through the creation of new jobs and opportunities, while mitigating hardships and disadvantages. Although, there is no universal economic development plan for every community, each area contains its own unique challenges, thus it is dependent upon the leaders of that area to plan and adjust accordingly in order to achieve the best possible results.

A major factor of economic development in any community is its logistics network. Logistics and economic development work in tandem with one another, as logistics is the life blood of any economy. Manufacturing and trade sectors are dependent on their products being efficiently moved from supplier to end consumer, and the logistics sector is solely responsible for that process (Sezer, Abasiz 2017). As a result of these factors, logistics, in certain areas, is either a catalyst for economic growth or an inhibitor to the scalability of industries. The scope of the logistics infrastructure available in an area is what determines whether the industry will be beneficial or detrimental. A robust logistics network will help facilitate ease or resource circulation, whereas a minimal network will hinder the amount of resources that can be moved, and the time it will take to move them.

If a community finds itself limited by the extent of its logistics network, activities should be directed at developing this network as it is the foundation for growth in many other industries.

The five largest economies in the world boast some of the most prevalent transportation systems in the world including ports, rail systems, and roads. This is not mere coincidence, it is because of these massive logistics networks that countries such as the United States, China, and Japan are able to create such robust, international economies. Neglecting the development of logistics infrastructure will only be detrimental to long term future growth of the region's economy.

The state of Georgia recognized the importance of logistics development and began enacting ways to help stimulate logistics growth. They accomplished this by creating specialized economic development units solely devoted to the growth of one particular sector. These units were aptly named innovation clusters. They focused on aerospace, energy technology, information technology, manufacturing and logistics. The Center of Innovation for Logistics (COIL) is the cluster responsible for overseeing and coordinating all logistics based economic development projects operating in the state of Georgia.

Some of the activities COIL pursued while I was working with them included: processing information requests for specific logistics infrastructure availability throughout the state, coordinating with external businesses who are considering moving/opening operations in Georgia, organizing inter-state autonomous trucking testing, and hosting the annual Georgia logistics summit. All of these responsibilities are being processed and completed by a four-member team. This can be quite time consuming, as much of their work requires querying the same type of information repetitively. In this project, I worked to discover how the implementation of a web-based data tool that aggregates all of their logistics info into one centralized location with easy filter options and a map visual that could help to streamline report processing time. The two main points we were looking to address were:

1. How can web-based tools be utilized to improve reporting and request process efficiency for the Center for Innovation and Logistics (COIL)?
2. How can web-based tools be utilized to support CIL leadership in providing information services for clients in logistics markets?

2. Background & Literature Review

2.1. Economic Development and Technology

In the *World Development Report 2020*, the World Bank examine the impact that Global Value Chains (GVCs) have had on the development of the global economy since 1990 and how their role is being redefined in the wake of new technologies that might disrupt the traditional trade growth model (Buelens and Tirpak 2017; World Bank 2020). GVC's played a significant role in globalization from 1990-2008, but ever since the financial crisis, trade growth has stymied. In addition, the advent of new technologies in additive manufacturing and global conflicts raises the question of whether they will ever realize the growth rates that had seen in years prior. The *World Development Report* 2020 examines how GVC's role needs to be redefined to ensure future economic growth. 3-D printing, 5G networks, and the Internet of Things (IOT) could help to move production closer to the consumer and reduce labor demands which would shuffle the current supply chain system. However, this reshuffling could create opportunities for developing countries to grow their own economies through domestic efforts, provided they were equipped with the correct equipment and infrastructure. (Artuc et al. 2018; World Bank 2020). The success of any system will be dependent upon the widespread promotion

of GVC participation and the implementation of open, predictable policies that encourage multilateral cooperation.

2.2. Economic Development and Logistics

The *Data analysis for metropolitan economic and logistics development* report examines the relationship between logistics advancement and economic growth in a metropolitan environment using five Chinese cities: Beijing, Shanghai, Guangzhou, Chongqing, and Tianjin as the test groups. Their aim was to establish a quantitative correlation between logistics growth and economic growth. They used Value-Added of the Tertiary Industry, GDP per capita, Total Retail Sales of Consumer Goods, Per Capita Disposable Income of Urban Households, Household Consumption Level and Public Finance Revenue as their economic development indexes. On the other hand, the Number of Logistic Employees, Total Fixed Asset Investment in Logistics, Total Postal Business Volume, Civilian Truck Holdings, Road Freight Turnover, Total Length of Postal Routes and Highway Mileage as their logistics indices (Gao, Yinping 2016; metropolitan economic and logistics development 2017). Using the entropy method and Granger causality statistical tests, they were able to determine that metropolitan logistics is conducive to economic development. Based on the indexes that were used, the researchers were able to derive that this came from the logistics infrastructure's ability to provide widespread transportation which speeds up the convergence and flow of necessary resources. This improves the flow of goods both up and down the supply chain in industries such as: construction, manufacturing, and agriculture, all of which are essential economic drivers (Han, Wang, Li 2015; metropolitan economic and logistics development 2017). Additionally, it was noted that the advancement of logistics also made the environment more suitable to expand employment, increase taxes, and promote investment activities. It is worth noting that they also discovered a lagging effect

between logistics advancement and perceived economic growth. In other words, the positive effect of a new logistics endeavor is not immediately realized, however, the benefits slowly aggregate over time. This report also found the converse of the relationship between logistics and economic development to be true. That the regional economy has an influence on the development of logistics. They conducted this correlation analysis using the per capita disposable income of urban households and the total business volume of an area (Gao, Yinping 2016; metropolitan economic and logistics development 2017). They found that these two factors were a statistically valid measure of the capacity of a regional economy and, as such, an important indicator for the market demand of logistics in an area. In order to verify this, claim further, the author conducted a regression analysis between the number of retail sales for consumer goods and the number of logistics employees. The analysis showed a clear positive correlation between the two factors. In conclusion, the authors multi-faceted correlation and regression analysis of logistics development and economic development show a strong mutual influence.

2.3. Economic Development and Logistics: Georgia, United States

The *In Motion* report examines the overall impact the logistics industry had on the state of Georgia in the year 2018. Their "fundamental finding in this report is that Georgia's logistics industry is a substantial and dependable source of jobs, economic activity, and economic growth." Some specific findings they had for economic impact are as follows:

i. 165,386 direct jobs (not including state and local government jobs);
ii. 362,778 total jobs in all industries (7 percent of all jobs in Georgia);
iii. $60.7 billion in output/sales (6 percent of Georgia's total output/sales);
iv. $33.5 billion in state GDP (6 percent of Georgia's total GDP);
v. $21.8 billion in labor income (7 percent of Georgia's total labor income);

vi. $1.3 billion in tax revenues for state government; and $1.4 billion in tax revenues for local governments

Additionally, the author was able to identify that each direct job in the logistics industry was responsible for another 1.19 jobs in other industries because of spending related to logistics providers. This means that roughly 197,392 additional jobs are created from logistics activities because of the multiplier (re-spending) effect. This makes the total number of jobs created by the logistics industry in Georgia in excess of 360,000, meaning that roughly one in every fourteen jobs in the state owes its existence to the state's logistic industry (Quarterly Census of Employment and Wages 2019; University of Georgia 2019). Also, of the 60.7 billion in output, 32.6 billion was due to direct spending by logistics providers while 28.2 billion was created through the multiplier/re-spending impact (Non-Employer Statistics 2019; In Motion Logistics Report 2019). That makes the average output (sales) multiplier value for the state's logistics providers roughly 1.87. That essentially equates to every dollar of direct investment in the logistics industry creating an additional 87 cents for the economy of Georgia. All of these values are indicative of Georgia's growth as a logistics powerhouse. To further support this claim, the author compared expected growth values of logistics subsectors nationally for the period 2010-2017 compared to the values of Georgia. Consistently, Georgia outperformed the nationally expected rates by roughly 11% (Dun-Bradstreet Database 2019; In Motion Logistics Report 2019). Currently, Georgia's logistic sector is growing faster than the overall economy of Georgia and will continue to do so for years to come provided the trade war, COVID-19, or any other global crises do not continue to escalate, impeding trade. However, if growth continues largely uninhibited at the rates which it has been growing, as indicated by (reference the article here e.g. "and indicated by Scott (2020)), there is a lagging effect between logistics advancement and

economic growth. The economy of Georgia will soon realize the tremendous compounding benefits of its robust logistics sector.

3. Approach and Methodology

3.1 The Problem

The Center of Innovation for Logistics (COIL) serves as the central hub for all information and resources a company might require regarding the Logistics industry in Georgia. As part of these responsibilities, they would complete report requests that companies had about certain logistic infrastructure availability in particular areas of the state. An example of one of these reports would be a local farmer looking for a trucking company that operates near Bulloch County and offers refrigerated trailers for his meats that he wants to send to market. So, he might reach out to COIL to locate one such trucking company. Once COIL receives this request, one of their team members would get on google and start searching for companies that meet the farmers criteria. After a few phone calls they would have a list of potential companies that they could send back to the farmer that are able to carry his product. As one might be able to tell, individually googling and calling companies for every request can be very time consuming. Further, if you have dozens of requests coming in at one time, it will take most of the week just to get through all of them; while you may also be repeating efforts searching for similar info for different clients. How might this process be improved by centralizing all of this information into one easy to data tool?

3.2 Approach to Solution Development

The idea to fix the request processing time was to create a web based tool that would store information for 15,000 logistics companies that could be easily filtered down to major sectors (i.e. Third Party Logistics, Trucking, Rail, .etc) then further down to sub sectors (refrigerated, dry van, flat-bed, etc) while also providing a visual component with a color coded map that could show the proximity of companies to certain areas. This also allows the user to set radius parameters to certain areas to search for companies that way. The main focus of the tool was to aggregate all the information needed for report processing into a database and to add a user interface that included a simple filter system and map visual that could be used to query certain information. This ultimately reduces the amount of time needed to complete each request.

3.3 Data and Database

The backbone of this tool is the dataset that contains the information for the 15,000 companies. This data was put together by a third-party consulting firm, and it contained information on every company that was registered as a logistics company in the state at the time. It contained information concerning location, employment, NAICS, SIC, line of business, and specialized services. With this information we would be able to map each of the companies, assign each to a particular sector, and assign those with specialized services to a sub-sector. Additionally, this dataset was compiled with county and region datasets to allow greater filter option diversity and to facilitate easier geographic groupings for companies.

3.4 Development and Design

This tool, at its inception, was meant to be modeled off of a pre-existing aerospace tool and aimed to aggregate several data tables into one location while also providing a simple

interface that allows users to filter through companies by industry, subsector, and geographic location. The way this was accomplished was by taking the initial dataset of 15,000 companies that was created by an external consulting firm and geolocating all of the addresses of the companies in the file to obtain geographic coordinates for the map. Once we had the company's coordinates, we populated the map with 15,000 dots, each representing a different company. Next, using the framework of the similarly functioning aerospace tool and coding languages of HTML5 and JavaScript we created the layout of the tool and its basic filter system. Once the central components of the tool were in place, we began adding functionality to the different filter options. Lastly, we added the aesthetics that would make the tool easier to use, such as color coding the dots by sector and adding the economic region filter. The tool was meant only to be used internally by COIL, so it was locally hosted and launched via web browser.

4. Results

Screenshots of the tool can be seen below. Figure 1-1 depicts the filter options for the tool and can be broken down as such. The "Sector and Region" option allows the user to select which logistics sector (i.e. 3PL, Rail, Ocean, Air, Warehousing, Trucking, etc.) they want to search for, as well as which region of Georgia they want their results to be shown in. The next filter area, "Sub-Sector View," allows the user to search for particular services a company may offer within its sector. An example of this would be refrigerated trailers that a trucking company might offer as an auxiliary service. The customize map feature allows for greater visualization of available resources in certain areas. The "color counties by" radio buttons creates a color-coded density map of the selection chosen. "Draw Circle of Radius" will create a circle of a specified size around a dot of the user's choice. This can help when processing requests that specify a service be within a certain distance of a point. For example, trucking services located within 10

miles of exit 127 on I-16. The “Show Companies” option simply allows the user to filter the size of companies shown. The final options in this sector simply allows for the visualization of potential points of interests. The education radio buttons toggle schools that offer logistics education as a curriculum. Similarly, the airports radio buttons show airports and by whom that air strip is available to be used.

Figure 1-2 depicts the visual component of the tool, the map. The map of Georgia, covered with the colored dots, shows all 15,000 logistics companies from the initial dataset, each colored to represent the sector in which it operates. On the right side of this figure, the legend denotes how each of these colors correspond to specific logistic sectors, airports, or education training facilities.

Figure 1-1

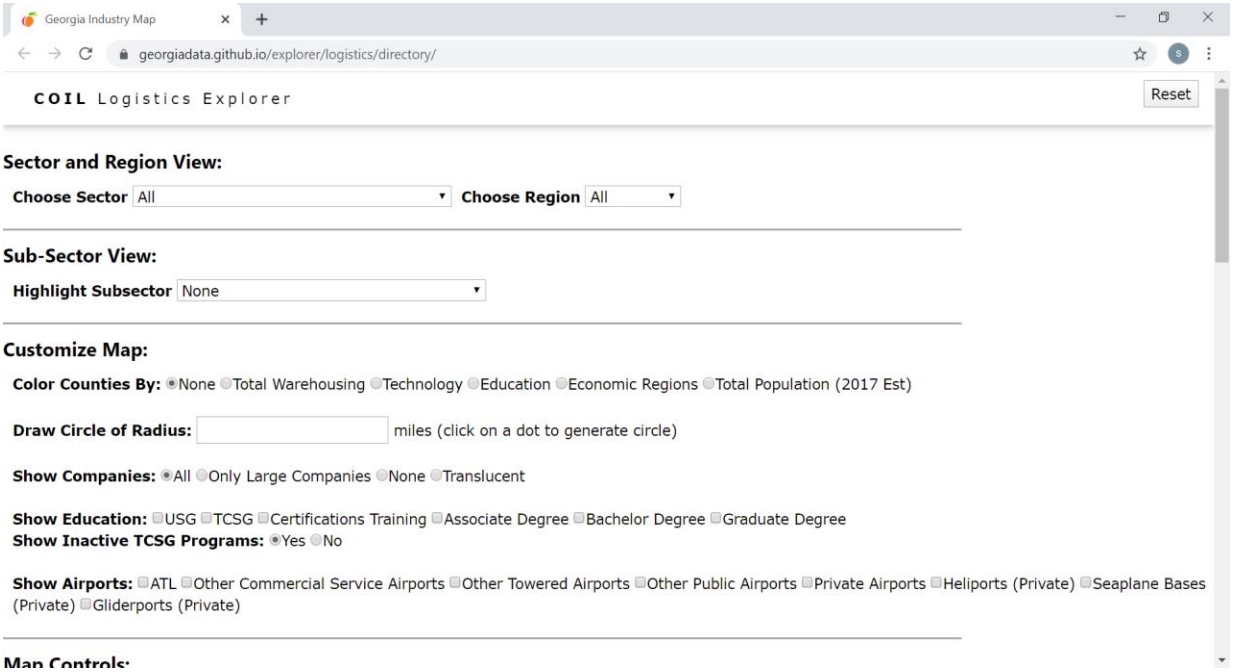
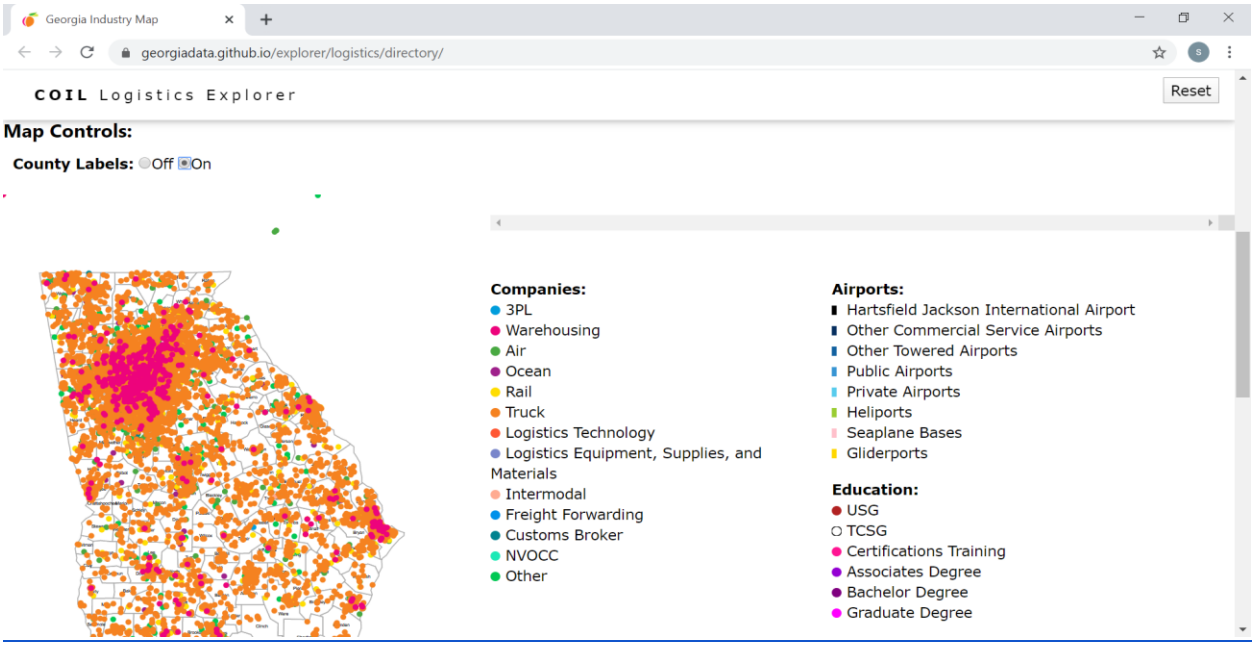


Figure 1-2



5. Discussion

Once the tool was completed, we distributed access to the rest of the team that would be using it via GitHub. We proceeded to test the tool by processing some initial information requests with it to ensure all of the functionalities were working properly. After we had discerned that everything was working as it should be and that the information it was producing was accurate, the tool was released for permanent use. The implementation of this tool helped in promoting information transparency across the organization, as all information queries were being pulled from this centralized resource. Additionally, the tool greatly improved the report processing time for information requests. As opposed to the previous system of individually searching for each request in Google, which required hours of browsing and repeated

expenditure of labor searching for the same thing, the data tool complies all of the necessary information into one source that can be filtered through to yield the optimal results. This greatly expedited the information reporting process.

5.1 Limitations of the application

There are a few functionalities that would have enhanced the tools overall usability, but could not be incorporated into the tool due to time constraints. The first of which was an export feature. There was discussion about the tool being able to take the results of a particular query and export them to an excel spreadsheet. This way the user could easily obtain all of the information stored in the dataset about the companies that met the specifications of the query and could simply share the file with the client that had requested the information. Secondly, a way to input new information into the dataset without having to manually pull up the file and search for the record that you want to change and then type the change you want to make directly into the file could be beneficial. This would have been beneficial for two reasons. One, it can be quite tedious combing through 15,000 records searching for the record the user wishes to change. Second, when the user is required to directly interact with the primary dataset that supports the tool, great precautions need to be taken in order to ensure nothing is accidentally changed. Even slight adjustments in this document could drastically affect the performance of the tool, and these mistakes could be very difficult to correct. Because of this, a Graphical User Interface (GUI) would be an excellent addition to the tool, as it would eliminate the previously listed problems by creating a safe and easy environment for a user to enter new information.

5.2 Opportunities for future development

The process of creating the decision support tool was relatively simple when compared to other methods of development, however, it is not the most effective means of development either. It would be quite easy to repurpose this tool for a similar use case, for example, the sustainable energy sector in Georgia. All that would be required is to replace the dataset the tool is pulling from and change the variable names of the dataset to match those that are hardcoded in the filter section. Through experiences gained following this project, I think the tool could be greatly improved by not running the tool in a browser. The browser is somewhat slow to process the large dataset, and there are a number of applications commercially available on the market that could process queries much faster. Tableau is one such application and could accomplish most of what is done by the tool with faster processing times as well as easier set up. Although, if one still wished to create their own tool, I would advise creating an application to run the dataset. This will allow for much more seamless processing and greater flexibility in the querying process.

6. Conclusion

In conclusion, the intersection between economic development and logistics development is undeniable. It has been shown that regions should endeavor to advance the abundance of logistic resources in their area as it is conducive to the growth of a multitude of other industries. The Economic Development Department of Georgia recognized the importance of logistics growth and consequently created the Innovation Clusters of Georgia, one of which is the Center of Innovation for Logistics and it is solely responsible for the advancement of Logistics infrastructure within the state. However, a bottleneck that was discovered in this organization was the way it processed information requests for logistic infrastructure availability

throughout the state. The organization's previous process was antiquated and involved individually searching each request in Google and recording the results to return to the client. This process was improved via the implementation of a web based data tool that aggregated information on all 15,000 logistics companies in Georgia and offered a simple to use graphical interface that the user could interact with to query certain geographical logistics information. This greatly improved report processing time as all of the information was now located in one central database. Which facilitated ease of processing multiple information requests back to back. While also adding a degree of transparency to the reporting process helping to streamline operations in the organization.

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