# BUSINESS ANALYTICS

**DALTON STATE**

## Inside

**CERE**
Center for Economic Research and Entrepreneurship

# In This Issue

*By Dr. Garen Evans, Editor*

This edition of *Business Analytics* is focused on Big Data. What is it, and where did this term come from? As Dr. Carl Gabrini explains in his debut article for *Business Analytics*, "Big Data and Small Government," the term was used first in reference to data visualization techniques at NASA in 1997. In 1998, John Mashey presented "Big Data and the Next Wave of InfraStress" while he was chief scientist at Silicon Graphics. Francis Diebold's article, "A Personal Perspective on the Origin(s) and Development of 'Big Data:' The Phenomenon, the Term, and the Discipline," describes how Mashey's presentation (at that time he used a physical deck of slides, not PowerPoint, which was not yet available), was the first to couple the term itself with an awareness of what Big Data was. Diebold goes on to describe Big Data as "not only a phenomenon and term, but also a discipline."

Mashey's description of "infrastress" forecasted the potential direction of demand for larger and larger data sets, and sounded the alarm for capacity issues, including physical space, computing power, and bandwidth, and for organizations too, "that grow quickly, [and] stress the management and support infrastructure." He implied firms would have limited understanding of business environments if they had data but couldn't locate it, or didn't understand how to use it.

A Google search today reveals the popular understanding that Big Data includes "extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions."

In this edition we have explored some of the issues swirling around Big Data: Drs. Lorraine Gardiner and Dong-Gook "DK" Kim reveal that Big Data "includes the ability to add value by converting the data into information useful for improved decisions and processes" by focusing on how to prepare students for the challenges that lie ahead; Dr. Marilyn Helms, the recently appointed dean of the Wright School of Business, explores how Big Data and vendor managed inventory can be advantageous in the supply-chain; Dr. Carl Gabrini looks at how small governmental organizations can use Big Data; and Dr. David Williams and Max England examine the implications of Big Data from the perspective of the 2016 presidential election, and how it might affect business operations today.

As Dalton State College celebrates its 50th anniversary, we spotlight the students and business professionals who "Run Boldly" with an update by Dr. Aisha Meeks and Marshall Jones on a selection of students in the Wright School of Business; and finally, I summarize the economic impacts of the Dalton State College on the regional economy. Please enjoy this issue.

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# Big Data, Small Government

*By Dr. Carl Gabrini*

The amount of data available today is vastly larger than what was available in the recent past. The ability to digitize data and the relatively inexpensive cost and ready availability of memory for storage means that we can capture more data than ever before with no real ceiling on future potential. The availability of data and the prevalence of computers in the workplace have increased the ability of individuals to perform more data analysis than in times past. Given the vast supply of data available, are smaller local governments able to enjoy the benefits of this treasure trove for their own analytic purposes, or are there constraints that might prevent them from doing so?

This increasing volume of data available is now referred to as "Big Data," a term first used by NASA in a 1997 research report about data visualization. In the report, the authors state that visualization relies on the availability of very large data sets, some so large that they potentially exceed an organization's storage capacity. This problem, they conclude, requires strategies for storing and making the data available to those needing access to it. Since this first mention of "Big Data," the definition has evolved beyond storage concerns to questions about the collection, storage, management, and analysis of "Big Data" sets. Gartner Group describes "Big Data" in terms of volume, velocity, and variety. Volume refers to the vastness of available data, velocity its rapid availability, and variety the number of sources. Often referred to as the three Vs of "Big Data" some have offered a fourth important V, value. This refers to the benefit versus cost of the data. All organizations have access to internal and external data. The key to successfully navigating the world of "Big Data" involves having the resources to access and use it. This is particularly true of internal data where the critical issues are knowing where it is and knowing how to access and process it.

Smaller local governments planning to use "Big Data" will need to ensure they have the resources to do so. The decision to use "Big Data" presents them with data management challenges. They need staff with knowledge of data management and analysis techniques to process data effectively into

useful information for decision and policy making. Staff must be trained to use software tools such as SQL, Microsoft Access, and intermediate to advanced spreadsheet analysis techniques. It is very helpful if some staff can use computer programming languages, such as Visual Basic. Visual Basic is embedded within Microsoft products and allows users to use the applications more effectively to perform advanced analysis. Local governments may find it useful to invest in software tools for their staff to perform data analysis, such as ACL, IDEA, Tableau, and SAS.

Local governments have access to large internal data sets of which they may not be aware. These internal data sets may be difficult to access. Many smaller organizations still rely on manual records. Much of the data found in these records is on paper and may be stored in warehouses where it is subject to deterioration or destruction. Staff frequently use spreadsheets for data collection and analysis. Spreadsheets, while powerful, may not be accessible to everyone. They may not be linked to the major systems nor stored on the networks used by the administration making knowledge of their existence and access to them difficult. They are also at risk of being corrupted or lost. Other data sets may be stored within older legacy computer systems. These systems often do not communicate easily with newer systems acquired to enhance the government's operational capabilities. While data migration is possible, there is a significant cost involved because of the time and expertise involved.

The fourth V described earlier referring to the cost/benefit analysis of "Big Data," and the related analytics presents yet another challenge. Local government leaders should approach using "Big Data" sets in an organized way. It is important to have an inventory of what is available, who manages it, where it is located, and how it is stored. It is extremely useful to have data directories of all the data sets, regardless of whether they are digital or manual, centralized or decentralized. An inventory of all data sets would provide a useful starting point for determining potential uses of the data. Local government leaders should be careful not to fall into the trap of performing data analysis because it is available and trendy. Leaders should understand why particular analyses are useful. What questions need answers? How will data analytics add value to policy and decision making? Will the local government's stakeholders such as citizens see value in expending resources on data analytics? Would it be beneficial to educate stakeholders on the value of the analytics before committing to performing them? The local government's leaders need to assess carefully their information needs and understand the costs relative to the benefits of working with "Big Data" and data analytics.

Smaller local governments have access to "Big Data" and can overcome the constraints. The challenges faced when deciding to make use of "Big Data" involves the investment in existing and future staff. Staff must be properly trained to collect, manage, and process "Big Data," and perform data analysis. The use of "Big Data" requires an investment in software applications to perform data analytics. Managing "Big Data" requires a complete inventory of all the small government's internal data. The inventory should be comprehensive and complete. Finally, local government leaders should assess the value relative to the costs of making use of "Big Data." The decision to use "Big Data" should be an organized and thoughtful exercise. Not done piecemeal over time. Local governments may find significant intrinsic value in managing "Big Data," and it may help them to improve their decision and policy making if planned carefully.

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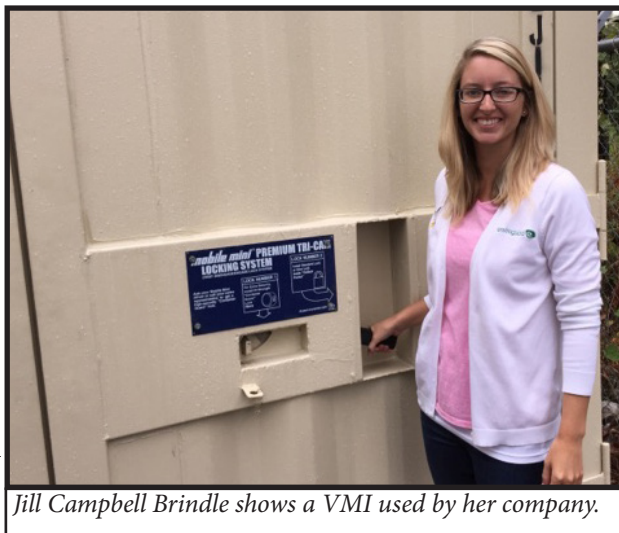# Big Data Can Lead to Vendor Managed Inventory Advantages

*By Dr. Marilyn Helms*

Big Data is best known for helping manufacturing organization meet the needs of their end users so they have the right products, available at the right time, at the right price, at the right place, and in the right quantity. Big Data offers benefits at the other end of the supply chain as suppliers meet the product demands of their manufacturing or service customers. The best example of sharing inventory management data is commonly referred to as Vendor Managed Inventory.

APICS, the Association for Supply Chain Management's Dictionary (15th edition available at www. apics.org) defines vendor-managed inventory as: "a means of optimizing supply chain performance in which the supplier has access to the customers' inventory data and is responsible for maintaining the inventory level required by the customer, accomplished by a process in which resupply is performed by the inventory through regularly scheduled reviews of the on-site inventory. The on-site inventory is counted, damaged or outdated goods are removed, and the inventory is restocked to predefined levels. The vendor obtains a receipt for the restocked inventory and invoices the customer accordingly."

The supplier of goods, usually the manufacturer or distributor, is responsible for optimizing



*Jill Campbell Brindle shows a VMI used by her company.*

inventory held by the customer. The goods are in the possession of the customer but remain the property of the manufacturer until they are used by the customer. A formal, contractual agreement remains in place between the two.

Benefits of VMI are rapid replenishment of inventory and lowering of the associated costs along with an improvement in inventory turnover. Using VMI, the buyer is able to access the inventory on-hand and can quickly replenish inventory to avoid stock-outs. The vendor or product supplier experiences fewer rush orders that could cause disruptions in the supply chain and trigger increased costs in ordering, transportation, and even in the quantities, as minimum orders may be required. VMI also reduces inventory in the supply chain.

Correct, and lower inventories, means customers can have a significant cost savings. Customers also have reduced purchasing costs and save time in completing purchase requisitions. The vendor receives data instead of purchase orders and there is no need to make corrections. The model can anticipate seasonal increases in product needs or promotional plans allowing appropriate stock to be available. Suppliers also earn the trust of the customer and therefore are likely to remain a trusted, long-term product supplier.

An advantage to the buyer is having inventory on-site and paying only for products when they are used. The supplier typically will give credit for the products that are unsold. This model has been frequently used by Wal-Mart and other big-box retailers like Home Depot. VMI is being extended to smaller companies as well.

As an example, Univar's Environmental Sciences is the largest distributor serving the pest management industry in North America and operates more than 60 ProCenters in the United States, Canada, and Mexico.

Employees of Enviroguard Pest Solutions of Ringgold drove to Univar's warehouse in downtown Chattanooga, Tenn. for needed supplies. Supplies were only available during weekday store hours. Specialty products were often unavailable and had to be shipped. Recently, Univar chose Enviroguard to participate in their VMI. Univar supplied a "mobile-mini" pod for product storage. The 20-foot container was delivered and installed. At a specified time, a truck carrying the agreed upon inventory arrived. Employees stocked and organized the shipment of supplies and checked the shipping manifest.

Glen Thomas, Univar Sales Representative notes, "Univar developed the program to provide a convenient and efficient way to get products to customers. In the pest control industry, many companies order products as needed, and the reliability of logistics (i.e. delivery services) were always unpredictable and at times resulted in a loss of business when supplies did not arrive on time."

"When trying to resolve these logistical problems for customers everything else fell into place with the mobile-mini program benefiting both the customer and the distributor. Customer advantages are having products on-hand and eliminating the time-consuming chore of ordering and maintaining inventory," Thomas notes. "This puts the pest control company ahead of the game, enabling them to provide better customer service while operating a more successful business. In addition, they only have to deal with one monthly invoice, making record keeping and bill paying simple and less time consuming."

For Univar, Thomas added that VMI, "provides the distributor savings in shipping costs and overall labor by preparing only one monthly shipment opposed to several different shipments per month. It further ensures that a representative from Univar is on-site at Enviroguard once a month improving customer relationships and keeping the company up to date on market trends."

The provided storage container adds minimal costs to the program, and the overall savings out-weighs those expenses and provides a positive business model for Univar.

"I personally believe that when a company invests in every customer, a circle of success results that benefits everyone and hopefully creates a happy and loyal customer for life," Thomas said. VMI helps the supplier avoid warehousing costs and the overhead (rent, insurance, employees) that are part of the storage costs.

The buying organization saves time and money as well. Jill Campbell Brindle, Enviroguard Office Manager (DSC BBA, Spring 2015) states, "This is one of the smartest initiatives a small business can implement. It saves our company time, and we always have ready access to all the supplies we need."

"A designated technician is responsible for overseeing the inventory and managing supply allocation to all other employees," Brindle said. "The VMI is also the subject of the technician's internship in Supply Chain Management at Georgia Northwestern Technical College in Ringgold."

She further noted that the mobile-mini pod can be customized with the company's name and phone number. Since Enviroguard it is visible from I-75, it also serves as a marketing tool for the company.

# Preparing Students for Data-Driven Workplaces

*Dr. Lorraine R. Gardiner and Dr. Dong-Gook Kim*

Gartner, Inc. defines Big Data as, "high-volume, high-velocity and/or high-variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision making, and process

**Table 1. DSA Job Descriptions**

| DSA Framework Category | Functional Role | Sample Occupations |
|---|---|---|
| Data Scientists & Advanced Analytics | Create sophisticated analytical models used to build new datasets and derive new insights from data | Data Scientist Economist |
| Data Analysts | Leverage data analysis and modeling techniques to solve problems and glean insight across functional domains | Data Analysts Business Intelligence Analyst |
| Data Systems Developers | Design, build and maintain and organization's data and analytical infrastructure | Systems Analyst Database Administrator |
| Analytics Managers | Oversee analytical operations and communicate insights to executives | Chief Analytics Officer Marketing Analytics Manager |
| Functional Analysts | Utilize data and analytical models to inform specific functions and business decisions | Business Analyst Financial Analyst |
| Data-Driven Decision Makers | Leverage data to inform strategic and operational decisions | IT Project Manager Marketing Manager |

(Analytical Rigor ↑)

automation." Volume, velocity and variety are known as the "three Vs" of Big Data. Volume concerns the total quantity of data; for example, Facebook's store of over 250 billion images. Velocity describes the rate at which relevant data are created. Today's automated manufacturing environments illustrate high velocity with large quantities of data being captured by sensors and data collection devices. Variety indicates types of data (e.g., email messages, sensor data, log files, audio files and images) captured for processing. According to a recent study of Fortune 1,000 companies, variety provides the largest challenge for many organizations.

The aforementioned definition of Big Data refers to much more than the capability of storing and processing "three V" data. It includes the ability to add value by converting the data into information useful for improved decisions and processes. For this reason, Big Data is increasingly becoming part of standard business practice with over 95 percent of Fortune 1,000 companies reporting at least one Big Data project in the last five years. Two of the largest employers in North Georgia, Mohawk Industries and Shaw Industries, have recent publicly available accounts of some of

their Big Data practices. Mohawk is implementing SAP HANA to help address information needs across its business units. Shaw has partnered with Lead Tool to provide its retail partners with access to a Big Data customer relationship management platform.

Even though Big Data is more popular among large companies, it is not just for them. Increasingly more small and medium-sized enterprises are utilizing (big) data that once were considered too costly to analyze, due to easy-to-use analytics software and falling costs. This means many small and medium enterprises in Northwest Georgia can take the advantage of various Big Data technologies, and they will need talent for this increasingly important task.

While most Fortune 1,000 companies have initiated Big Data projects, only about 48 percent reported measurable results from them. Successful Big Data initiatives require a blend of technical and organizational capabilities, some of which are new and driven by Big Data demands. For example, Big Data analytics demand skills beyond typical statistics courses and data storage technologies beyond traditional databases to accommodate the radically increased data volume, velocity, and variety. Further, domain experts are critical in identifying which questions and problems to address with Big Data initiatives in order to be aligned with organizational objectives.

**Data Science and Analytics Jobs and Skills**

In a report conducted for IBM and the Business-Higher Education Forum, Burning Glass Technologies identifies six in-demand data science

**Table 2. Summary Demand Statistics**

| DSA Framework Category | Number of Postings in 2015 | Projected 5-Year Growth | Estimated Postings for 2020 | Average Time to Fill (Days) | Average Annual Salary |
|---|---|---|---|---|---|
| All | 2,352,681 | 15% | 2,716,425 | 45 | $80,265 |
| Data-Driven Decision Makers | 812,099 | 14% | 922,428 | 48 | $91,467 |
| Functional Analysts | 770,441 | 17% | 901,743 | 40 | $69,162 |
| Data Systems Developers | 558,326 | 15% | 641,635 | 50 | $78,553 |
| Data Analysts | 124,325 | 16% | 143,926 | 38 | $69,949 |
| Data Scientists & Advanced Analysts | 48,347 | 28% | 61,799 | 46 | $94,576 |
| Analytics Managers | 39,143 | 15% | 44,894 | 43 | $105,909 |

Table 3. Top Analytical and Specialized Skills by DSA Category

| DSA category | In-demand skills |
|---|---|
| Analytics Managers | Financial Analysis<br>SQL<br>SAS<br>Data Analysis<br>Business Intelligence |
| Data Analysts | Data Analysis<br>SQL<br>Business Intelligence<br>Data Warehousing<br>SAS |
| Data Systems Developer | SQL<br>Database Administration<br>Extraction, Transformation, and Loading<br>Data Warehousing<br>Apache Hadoop |
| Data Scientists & Advanced Analysts | Apache Hadoop<br>Machine Learning<br>Big Data<br>R<br>Data Science |
| Data-Driven Decision Makers | SQL<br>Financial Analysis<br>Data Analysis<br>Data Management<br>Data Validation |
| Functional Analysts | Financial Analysis<br>SQL<br>Data Analysis<br>Data Management<br>SAS |

and analytics jobs and skills. Table 1 summarizes the functional roles and sample occupations of the six DSA categories with an assessment of the analytical rigor of each.

As shown in Table 2, demands for DSA-related jobs is expected to increase by at least 14 percent from 2015 to 2020 with the Data Scientists and Advanced Analysts category having the highest projected increase (28 percent), which is not surprising considering more firms are now competing on analytics and data.

Of special interest to colleges and universities are workforce educational entry requirements and specific skill sets. Many in-demand analytical skills required for Big Data consist of both established and new areas of expertise. Established information technology skills include, for example, SQL and database administration while newer skills such as Apache Hadoop have arisen due to the demands of handling high volume, velocity and variety data. The need for processing Big Data into useful information has driven demand for newer skillsets such as machine learning and the use of R and Python. Table 3 summarizes these in-demand skills for the six DSA categories.

**Wright School of Business Curriculum**

In recognition of the need for analytic and Big Data skills, the Wright School of Business added curriculum to better prepare its graduates for participation in an increasingly data-driven workplace. The School changed the core curriculum for all business students to include an additional quantitative course. In addition, the College has created a business analytics minor which specifically targets many of the skills identified in Table 3. Required courses in the minor, open to all business students, cover a mixture of traditional and newer analytic skills and expose students to leading software such as R. Elective courses, also open to all business students, offer a variety of skills from programming to big-data database technologies such as Hadoop and SAP HANA.

The report by Burning Glass Technologies shows that most DSA categories do not currently appear to require master's degrees or higher, but do require at least three years of work experience. This means students will likely need to continue building their skills after graduating from college before becoming eligible for most DSA job categories. Even though our curriculum cannot cover all in-demand analytical skills, we are confident that it lays a solid foundation for further skill development for interested students.

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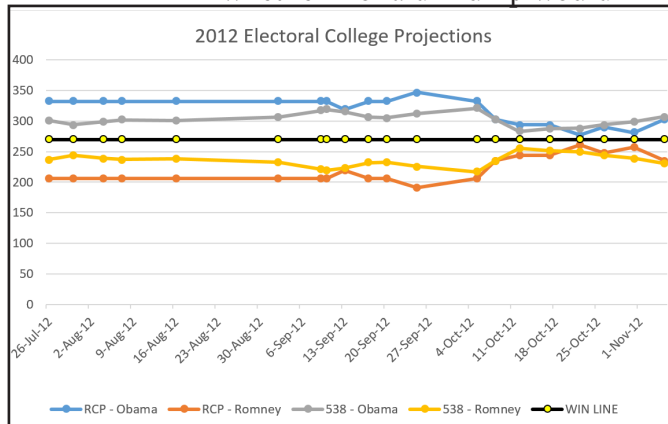# Big Data: The 2016 Presidential Race as a Cautionary Tale

*By Dr. David L. Williams and Max England*

The 2012 presidential election resulted in President Obama defeating Gov. Mitt Romney by 4 percentage points in the popular vote (roughly five million votes). Additionally, the president won 62 percent of the Electoral College in his successful re-election bid. Moreover, he never trailed, according to the public polling and election modelers, during the time data was recorded (July 2012 – November 2016). Or to put it more simply, President Obama was never projected to earn less than the 270 electoral votes necessary to win and Gov. Romney was never projected to reach 270 electoral votes according to one organization that averaged polls (realclearpolitics.com) and one organization that incorporated polling as a component of a more complex model (fivethirtyeight.com).

During the 2012 cycle, statisticians from Stanford, Emory, and Princeton (among others) all agreed that an Obama victory was overwhelmingly likely. Meanwhile, mainstream news sources, relying on intuition, insider information, pundits, and preferred polling (often polling they paid for) regularly hyped some variation of a 'horserace', 'too close to call', 'neck and neck' presidential race.

In the 2016 presidential cycle, polling and modeling data was again collected, adding some reputable statisticians and modelers to the two that we tracked during the 2012 cycle. Two weeks before Election Day, guided by the 2012 data, the only questions we had about the Nov. 8, 2016 Electoral College results were whether Secretary Hillary Clinton would reach 350 electoral votes and whether Donald Trump would
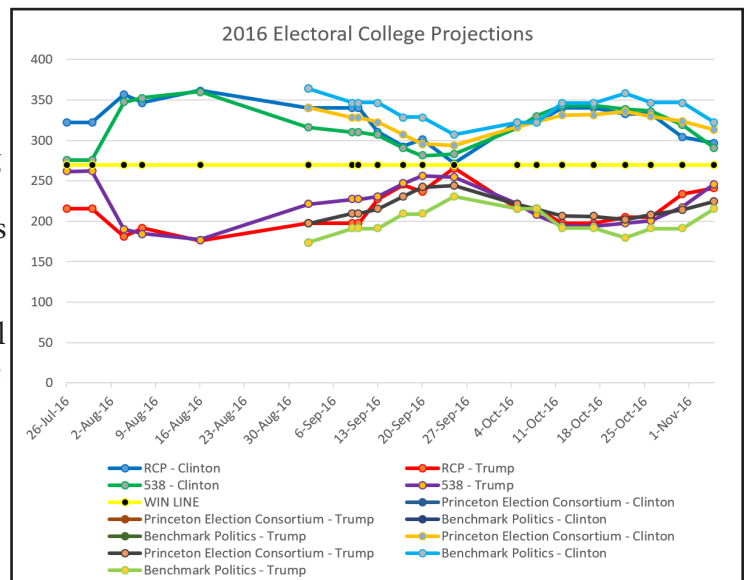


2012 Electoral College Projections

reach 200. During the time of the 2016 data collection, news outlets wrote or broadcasted over 160 segments or stories hyping another 'too close to call' presidential election. That may be the only commonality between the 2012 and 2016 presidential elections.

The 2016 presidential race should serve as a kind of warning to the business community who have become obsessed with "Big Data." Millions of dollars are being spent all over the United States and the world on this young science. The goal is to create value by improving marketing, medical diagnoses, employee recruitment, etc. However, to rely too heavily on data driven-decision making is to perhaps place too much faith in a mostly blunt instrument (e.g. 2016 Electoral College projections). The Electoral College defeat of Secretary Clinton provides some support to the argument that projections are only as good as the data being collected to make those projections. Additionally, add multifarious humans to the mix, and things can get somewhat volatile.

Meteorologists rarely forecast beyond 10 days, and they are working with hundreds of years of data. However, firms regularly expect one or two decades of data to explain and predict consumer behavior, or as in the 2016 presidential election, voter behavior. As Erik Brynjolfsson, a professor at the Sloan School of Management, put it recently in the *New York Times,* "The key thing to understand is that data science is a tool that is not necessarily going to give you answers, but probabilities." As the business community rapidly embraces the predictions fueled by Big Data we think it wise to remember Professor Brynjolfsson's cautionary words.



2016 Electoral College Projections

# Business Professionals Run Boldly

*By Marshall Jones and Dr. Aisha Meeks*

The Wright School of Business continues to prepare business professionals who Run Boldly. Walking through the halls of Memorial it is possible you will hear the friendly banter of Dr. David Williams arguing that marketing rules the world of business, while down the stairs you will hear the recognizable voices of Dr. Aisha Meeks and Professor Jamie Connors exclaiming that "In the accounting department, all we do is win!" The Wright School of Business has continued to produce quality professionals who possess the knowledge, skills, and experience necessary to make immediate and lasting impacts within the respective industries and organizations in the Northwest Georgia area, as well as around the world.

In this first Student Spotlight we identify some of the many business students who have exceeded expectations. These students come from every background imaginable, but share the common theme that Dalton State College has facilitated the advancement of their professional careers.

**Hunter Lewis** is a senior accounting student at Dalton State, who served as a financial analyst intern with Tennessee Valley Authority for two years. In addition, Lewis recently accepted a full-time post-graduation offer to continue with TVA in a new role as a financial analyst.

**Ivan Delgado** is a 2017 graduate with a degree in accounting, who previously served as an advisory accounting and reporting technology intern with Deloitte. He is currently studying to obtain his Certified Public Accountant designation, and has accepted a full time offer within the advisory department of Deloitte. Deloitte, Touche & Tohmatsu Limited is a world renowned accounting firm, and is often ranked as the top accounting firm in the world.

**Ruben Hernandez** is a May 2016 graduate with a degree in management. Hernandez served as a procurement intern with United Postal Service, as well as an e-commerce intern with Mohawk Industries. Hernandez now serves as a supply chain associate with Mohawk, and aims to continue his work within supply chain management, as well as remaining actively involved within the Northwest Georgia area.

**Adriana Hernandez** is currently pursuing her degree in accounting. Hernandez works as an international accountant within the accounting department at Shaw Industries. She previously held numerous titles throughout her co-op program at Shaw, including internal audit intern and corporate tax intern. After graduation, Hernandez plans to pursue her Certified Public Accountant designation, while continuing her work within the international accounting department at Shaw.

**Manuel Martinez** has found his passion in the real estate profession. He obtained his bachelor's degree in business administration from Dalton State, and continued his studies at Belhaven University, where he received his master's in business administration. As a proud member of the Keller Williams Realty team, Martinez serves clients around the Chattanooga and North Georgia area. He prides himself on providing the best customer service experience possible.

**Marshall Jones** is a current student pursuing his degree in accounting with an anticipated graduation date of Fall 2017. Jones works in the accounting department of Sequatchie Concrete Service, a leading manufacturer of both ready-mix concrete as well as concrete blocks located in Chattanooga. Previously, Jones worked as an accounting clerk for Complete Recycling and Demolition, a construction and demolition company in Ringgold. After graduation he plans to obtain his CPA designation, and pursue a master's of business administration degree.

These individuals represent organizations of all levels, such as Fortune 500 companies, global manufacturing leaders, elite accounting firms, and government organizations, as well as leading companies in local industry.

# The Economic Impact of Dalton State College: Fiscal Year 2016

*By Dr. Garen Evans*

Recently the University System of Georgia released a report on the economic impact of its universities, colleges, and other institutions. The report, commissioned by the Board of Regents and based on data from July 1, 2015 through June 30, 2016, included a summary of system-wide impacts, as well as the economic impacts of each institution conveyed to the community in which it was located. This included Dalton State College.

Economic impacts are typically estimated using sophisticated economic models. These models account for the numerous interactions that occur in the economy using an input-output framework. The idea behind input-output analysis is that a change in demand for goods or services lead to a change in the level of input required to produce that good or service. It doesn't stop there though. Next, the change in the level of inputs required by these suppliers also changes the level of output by other producers who supply those inputs. This is referred to as an inter-industry transaction. And those suppliers affect the level of output by additional upstream suppliers.

For example, when enrollment increases at Dalton State, more students purchase hamburgers for lunch. This leads to restaurants ordering more hamburger buns, and other variable inputs. This in turn leads to suppliers of hamburger buns ordering more flour, which consequently affects the amount of wheat ordered by flour mills, fuel purchased by transport services, and so forth. Input-output analysis accounts for these changes in the economy. The creator of input-output analysis is Wassily Leotief, an American economist who was awarded the Nobel Prize in 1973 for, "a method that provides tools for a systematic analysis of the complic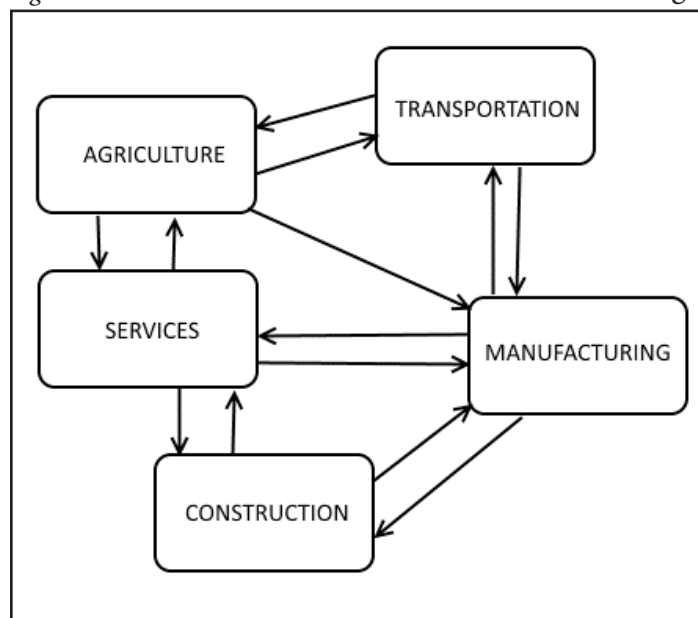ated inter-industry transactions in an economy." Another example is a simple economy with five sectors: agriculture, services, transportation, manufacturing, and construction (Figure 1); 13 of the potentially 20 different transactions that occur between these sectors are shown.

Modern input-output models track more than just inter-industry sales. They also account for household spending patterns, labor markets, and adjust for spending leakages that inevitably occur when inputs are purchased from outside the economic study area.

Input-output models are calibrated by considering an initial level of spending (i.e., direct effect) that represents a change to final demand for goods and services. Using this direct effect, the model tracks the changes to the economy, and estimates impacts on: output, or total spending; employment; and value added components, such as employee compensation, proprietary income, other property income, and indirect business taxes.

In 2016, initial spending associated with Dalton State College was more than $112 million; 57 percent of this spending was by students (Table 1). The estimated impact on economic output was $136.5 million of total spending. The College's total contribution to the region (i.e., Murray, Catoosa, Gordon, Walker, and Gilmer counties) was $84.9

*Figure 1*

million of total value added to the economy in the form of wages, business and property income, and indirect business taxes. This level of economic activity directly and indirectly supported 1,526 jobs of which 1,133 were off-campus, and

the economic impacts included: an output impact of $5.5 million, a value added impact of $1.5 million, a $1.2 million impact on labor income, and 33 jobs.

The authors of the report noted that Dalton State improves the skill, productivity, and lifetime earnings of graduates: "Local businesses benefit from easy access to a large pool of part-time and full-time workers. Moreover, companies and agencies

| Table 1. Economic Impact of Dalton State College on Regional Economy, Fiscal Year 2016 | | | | | |
|---|---|---|---|---|---|
|  | Direct | Output | Value Added | Labor Income | Employment |
| Personnel Services | 25,458,143 | 43,845,334 | 35,557,143 | 30,598,623 | 548 |
| Operating Expenses | 22,354,948 | 18,538,621 | 9,191,173 | 5,696,860 | 154 |
| Student Spending | 64,334,453 | 74,166,700 | 40,239,041 | 18,632,582 | 824 |
| **Total** | **112,147,544** | **136,550,655** | **84,987,356** | **54,928,064** | **1,526** |

more than $54.9 million of labor income.

Compared to 2015, initial spending increased 5.6 percent from $106.2 million, which resulted in higher estimated economic impacts (Table 2). The output impact increased 13.1 percent, the value added impact was 10.4 percent higher, the labor income impact increased by 13.7 percent, and the impact on employment was 8.5 percent higher compared to the previous year's report.

These results suggest that, compared to the previous year, the contributions that Dalton State College made to the regional economy increased. These results however do not include the economic impacts of capital outlays made during the year for new construction and other capital projects. In 2016 the college had $4 million of capital outlays, and

The increased level of economic impact on output means there is more spending in the economy associated with the college, compared to last year. Unfortunately spending impacts are subject to quite a bit of double-counting, because a dollar spent on one good is then re-spent downstream. For a more accurate picture one should focus on the impact on value added components. The data suggest that Dalton State makes significant contributions to the local economy, and that those contributions have increased over time. The value added impact shows that the College's presence in the region contributed $84 million dollars to the economy, which works out to roughly $16,000 per student.

depending on highly specialized skills often cluster near universities. This may be particularly true of high-tech and information-based companies, which despite the recent recession and sub-par recovery, are still expected to account for a disproportionately high share of future economic growth. Finally, the outreach and service units of the college or university provide valuable services to local businesses and residents. Cultural and educational programs and facilities often are available to the general public and provide intangible benefits to the host community by improving residents' quality of life."

| Table 2. Economic Impact of Dalton State College, Fiscal Year 2015 to Fiscal Year 2016 | | | | | |
|---|---|---|---|---|---|
|  | Direct | Output | Value Added | Labor Income | Employment |
| FY 2015 Total | 106,197,251 | 120,765,591 | 76,975,136 | 48,324,907 | 1,407 |
| FY 2016 Total | 112,147,544 | 136,550,655 | 84,987,356 | 54,928,064 | 1,526 |
| Change | 5,950,293 | 15,785,064 | 8,012,220 | 6,603,157 | 119 |
| Percent Change | 5.6% | 13.1% | 10.4% | 13.7% | 8.5% |

# Business Analytics Economic Dashboard Fall 2017

| Area | UNEMPLOYMENT RATE | FIRMS | | JOBS | | | WEEKLY WAGE | |
|---|---|---|---|---|---|---|---|---|
| | | 2016Q1 | 2017Q1 | 2016Q1 | 2017Q1 | Change | 2016Q1 | 2017Q1 |
| Bartow | 5.0% | 2,126 | 2,076 | 29,701 | 31,280 | 5.3% | 802 | 830 |
| Catoosa | 4.5% | 959 | 924 | 11,202 | 12,059 | 7.6% | 599 | 627 |
| Chattooga | 5.0% | 302 | 293 | 4,879 | 4,966 | 1.8% | 616 | 622 |
| Dade | 5.2% | 236 | 228 | 2,758 | 2,691 | -2.4% | 616 | 677 |
| Fannin | 4.8% | 606 | 600 | 5,039 | 5,231 | 3.8% | 536 | 569 |
| Floyd | 6.2% | 1,992 | 1,889 | 32,610 | 33,400 | 2.4% | 766 | 797 |
| Gilmer | 6.3% | 572 | 543 | 5,914 | 5,613 | -5.1% | 561 | 589 |
| Gordon | 5.3% | 1,016 | 992 | 17,148 | 18,623 | 8.6% | 758 | 916 |
| Haralson | 5.1% | 459 | 423 | 4,851 | 4,918 | 1.4% | 754 | 799 |
| Murray | 5.8% | 421 | 400 | 8,679 | 8,023 | -7.6% | 688 | 639 |
| Paulding | 4.5% | 2,010 | 1,972 | 16,959 | 18,245 | 7.6% | 605 | 641 |
| Pickens | 4.5% | 729 | 698 | 6,113 | 6,381 | 4.4% | 835 | 862 |
| Polk | 5.9% | 633 | 592 | 9,191 | 9,253 | 0.7% | 644 | 695 |
| Walker | 4.8% | 714 | 655 | 9,319 | 9,828 | 5.5% | 589 | 630 |
| Whitfield | 5.3% | 2,288 | 2,186 | 51,998 | 49,749 | -4.3% | 836 | 858 |
| Region | 5.2% | 15,063 | 14,471 | 216,360 | 220,260 | 1.8% | 680 | 717 |
| | | | | | | | | |
| Georgia | 4.7% | 283,762 | 267,834 | 3,542,394 | 3,643,747 | 2.9% | 1,032 | 1,096 |

*Source: Bureau of Labor Statistics Quarterly Census of Employment and Wages; Unemployment rate (UER; June 2017 preliminary) from Georgia Department of Labor, Civilian Labor Force Estimates (http://tinyurl.com/ppem8jo).*

*Notes: number of firms and jobs are private industry data in levels, weekly wages are current dollars, not seasonally adjusted. 2017 is preliminary estimate; Regional weekly wage is average of counties in region.*

# DALTON STATE
## WRIGHT SCHOOL OF BUSINESS