NC STATE
Supply Chain Resource Cooperative
2018-2019 Fiscal Year Annual Report

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The Supply Chain Resource Cooperative is a unique, industry-university partnership dedicated to advancing the supply chain industry and the professionalism of its practitioners. The SCRC provides support, services, and programs to benefit three overlapping constituent groups: supply chain management students, supply chain thought leaders, and corporate partners. Businesses tap into the value and resources of NC State, and students gain knowledge and experience to prepare for the workforce.
CELEBRATING
20 YEARS OF
EXCELLENCE
The Poole College of Management at NC State University actively engages with industry and academia to create an innovative and collaborative intellectual environment that fosters learning, scholarship and service. We focus on developing and supporting leaders with an entrepreneurial mindset and analytical problem solving capabilities to positively impact our data-rich, dynamic, global economy.

& EXCELLENCE IN ALL ENDEAVERS
THINK AND DO
GUIDED STRATEGY AT THE SCRC

We are a unique industry-university partnership dedicated to advancing the supply chain industry and the professionalism of its practitioners.

MISSION
To deliver real, bottom-line value to each of our constituencies.

VISION
To be recognized as a thought-leader in global supply chain management.

BRAND VALUES
“Solutions provider” and a portal for businesses to leverage the full resources of NC State.
To Our Partners,

Looking back on the 2018-2019 calendar year, it is incredible to think of all of the accomplishments we’ve achieved in 12 months! The sheer number of activities, student engagements, partner meetings and conversations and faculty interaction has been one of the best years yet. We established the SCRC to pursue a mission of thought leadership through applied student projects, academic research, applied research, and dissemination of results through online content and executive programs. We seek a high level of excellence through partnerships with other colleges within NC State (including engineering, textiles, manufacturing systems engineering and others), other universities, and private and public-sector partners who seek to drive change through emerging technologies and organizational transformation.

This year we’ve achieved many milestones including establishing partnerships with data providers such as Bloomberg, FreightWaves, Procurement IQ, Panjiva, and Weave. We’ve also worked with the MBA and undergraduate curriculum committees to revise courses to better emphasize analytics, decision support, and supply chain strategy. We are excited to continue our engagement with Boeing, UPS, Siemens Building Controls, VF Corporation, and Tompkins International through multidisciplinary research projects with five Ph.D. students in Operations Research, the Wilson College of Textiles, and Industrial Engineering. Additionally, we are excited to partner with Dr. Noel Greis and Dr. Monica Nogueira, who bring with them partnerships with Boeing, the Department of Defense, and other industrial partners; on research focused on the application of machine learning and tools of artificial intelligence to create “smart” manufacturing processes and “connected” products that help companies improve their manufacturing and supply chain operations.

To say we’ve been busy is an understatement! We’ve had the distinct honor of presenting at several conferences, including at the Institute for Supply Management, Council for Supply Chain Management Professionals, Veteran’s Affairs, General Services Administration, UPS Healthcare Forum, Lenovo Executive Programs in Supply Chain, Georgia State Executive Forum, Penn State Executive Programs in Supply Chain, and the National Association of State Procurement Officials (NASPO) Academi Forum.

As we move into the next academic year, we look forward to continuing working with our dedicated team of faculty, executives advisors, staff, students, and resource associates, to help you identify and address opportunities for growth and transformation in your organization. Thanks to everyone for making us so successful. This report provides more details on the activities over the past year, and if you want to learn more, of course, don’t hesitate to send us a note or give us a call.

Best regards,

Rob Handfield
PROJECTS

25-30
Projects Per
Academic
Semester

REAL INDUSTRY SITUATIONS
THROUGH STRUCTURED TEAM
PROJECTS

ADDRESS

25-30
Projects Per
Academic
Semester

REAL INDUSTRY SITUATIONS
THROUGH STRUCTURED TEAM
PROJECTS

DRIVE

PERFORMANCE FOR
STUDENTS, FACULTY, AND
BUSINESS PARTNERS
THROUGH TRADITIONAL AND
NON-TRADITIONAL METHODS

STUDENTS RECEIVE
ACADEMIC AND
REAL-WORLD
EXPERIENCES

RESEARCH AND
CONSULTING
OPPORTUNITIES

BUSINESSES
PIPELINE TALENTED
RECRUITS

DELIVER

RESULTS BY IDENTIFYING
OPPORTUNITIES FOR BUSINESS
AND MOVING IDEAS FORWARD
INTO ACTION

780
PROJECTS

2500
STUDENTS

60+
COMPANIES

ADD

VALUE FOR STUDENTS, FACULTY, AND
BUSINESS PARTNERS

> Project reviews to adjust scope, relevance, and applicability
> Project research and materials provided to partners
> Implementation recommendations
> Stakeholder technology and/or process transition sessions

1. PLANNING
2. ANALYSIS
3. INTEGRATION
4. IMPLEMENTATION
We educate through MBA and UG practicums, and doctoral student research. We disseminate knowledge through conference presentations, web content, videos, podcasts, workshops, and training programs.

ACCOMPLISHING OUR MISSION

Knowledge
Comprehension
Application
Analysis
Synthesis
Evaluation
VF Corporation (NYSE: VFC) is a global leader in the design, manufacture, marketing and distribution of branded lifestyle apparel, footwear and accessories. The company’s diversified portfolio of powerful brands spans numerous geographies, product categories, consumer demographics and sales channels, giving VF a unique industry position and the ability to create sustainable, long-term growth for our customers and shareholders. The company’s largest brands are The North Face®, Vans®, Timberland®, Wrangler®, Lee® and Nautica®. For more information, visit www.vfc.com.

Small teams of faculty and students work on challenging supply chain issues directly with our partners. Businesses get real solutions, valuable objective insights, innovative analytic solutions and access to an up-and-coming workforce.

Our industry partnerships are simple: Faculty lead a team of supply chain management students to research, define and solve supply chain problems. The partnership team makes executable recommendations to provide solutions to real-world supply chain problems. These proposals result in real returns when implemented, ultimately advancing the supply chain industry and positioning both students and businesses for success. Think reduced cost, enhanced profits and increased efficiency.

Want to work with us? Geography is no boundary: We partner locally, nationally and internationally, so students gain the technology and planning skills needed to succeed in a global business environment.

Contact us to learn more about partnering with the SCRC and the benefits we can offer your business.
UPS
NEW PARTNER COMPANY

Founded in 1907 as a messenger company in the United States, UPS has grown into a multi-billion-dollar corporation by clearly focusing on the goal of enabling commerce around the globe. Today, UPS is a global company with one of the most recognized and admired brands in the world. We have become the world’s largest package delivery company and a leading global provider of specialized transportation and logistics services. Every day, we manage the flow of goods, funds, and information in more than 200 countries and territories worldwide.
Procurement and Supply Management is no longer about sourcing products and services at the lowest cost. For leading organizations it is about investing the companies money in supplier products and services that will deliver the maximum sustainable return on investment possible. This means optimizing the performance of the supplier, the customer and the relationship between the two.

- Ian George, Owner, ProPar Consulting
PROJECT COURSES

**BUS 479**
UNDERGRADUATE SUPPLY CHAIN PRACTICUM

This is a SCM concentration course consisting of a team-based project working with a Supply Chain Resource Cooperative (SCRC) partner company to resolve real-world SCM issues. There is typically a mix of projects that focus on SCM topics such as procurement, logistics, transportation, distribution, materials management, forecasting, sustainability, and operations; yet remain integrated across a variety of SCM issues.

**MBA 541**
SUPPLY MANAGEMENT

This course is designed around stages in the category management process including stakeholder engagement, spend analysis, market intelligence, strategic sourcing, negotiation, relational contracting, and on-going management of supply chain relationships. Every student will participate in a team-based supply chain project with an organization and will learn the team-based, deadline-driven nature of supply chain initiatives in a real-company setting.

**MBA 549**
SUPPLY CHAIN PRACTICUM

This is a required course in the SCM focus area. This course is comprised of a team-based project working on an SCRC partner company’s SCM issues. Students will study technical supply chain issues particular to each project and will learn the team-based, deadline-driven nature of supply chain initiatives in a real company setting.

**MBA 590**
ANALYTICAL SUPPLY CHAIN MANAGEMENT

The objective of this MBA course is to build an understanding of how to manage and improve the performance (efficiency and responsiveness) of operations and supply chains through decision making that is based on analysis and facts, rather than intuition. The course introduces fundamental aspects of operations and supply chain management as well as analytical modeling tools and techniques that can be used to support decision making (e.g., optimization, regression analysis, simulation). The approach taken in the course is entirely example-based and hands-on since all these techniques will be implemented in Excel, either with Excel’s built-in tools or with Excel add-ins.
RESEARCH AND WHITE PAPERS

WHITE PAPERS

"Beneficiary Vulnerability Analysis and Engagement for Apparel Industry in India: A Report on Forced Labor Conditions in India and Bangladesh."

"Driver Analysis and Strategic Review of Forced Labor Conditions: India and Bangladesh."

"Data Governance, Data Quality, and Artificial Intelligence in the Supply Chain."

"Addressing Labor Shortages in Warehouse and DC Operations."

PEER-REVIEWED PAPERS

"The Microfoundations of an Operational Capability in Digital Manufacturing."

"Do Prices Vary with Purchase Volumes in Healthcare Contracts?"

"Sustainable Supplier Selection and Order Allocation: A Novel Multi-Objective Programming Model with a Hybrid Solution Approach"

"Emerging Procurement Technology: Data Analytics and Cognitive Analytics."


"Early Supplier Integration in the U.S. Defense Industry."
Cohee, Lane, Barrows, Jeff, Handfield, Robert., Journal of Defense Analytics and Logistics, Accepted June 27, 2018.

OTHER REPORTS

"Combating Counterfeiting in the Supply Chain."

"Emerging Procurement Technology: Data Analytics and Cognitive Analytics."
LENOVO

PROCUREMENT MODERNIZATION TRENDS

As part of the supply chain transformation, there is a need to transform procurement. This need comes, in part, from the lack of full understanding of the current procurement processes and data storage locations. The procurement transformation is also intended to identify and address pain points in the procurement processes. In response to these needs, DCG is working toward end to end transparency in procurement as a part of the overall SC transformation and they also want to build upon their existing efforts in Artificial Intelligence (AI)/Watson, Internet of Things (IoT), and Blockchain.

There is also a desire to understand more about modernization trends in procurement and potential tools and resources for consideration as possible improvements. The digitization and modernization of procurement will help improve efficiency, by reducing bottlenecks and inaccuracies throughout the process and by creating transparency and access to data across the system. This will result in increased cost savings, while building a procurement system that can then be potentially sold to customers as a service solution. This added value as a customer solution will help DCG SC realize their goal of becoming a profit center.

BACKGROUND

Lenovo is a $43 billion company and a leader in providing innovative consumer, commercial, and enterprise technology. Lenovo’s Data Center Group (DCG) segment is undergoing a supply chain transformation, with one of the key strategies focusing on digitization of the supply chain and a second focus on monetization of the supply chain as a service, with a longer-term goal of turning supply chain into a profit center rather than a cost center.
16% OF CPOs FOCUSED ON DIGITAL SKILLS TRAINING

30% OF EMPLOYEES CONFIDENT WITH ANALYTICS

PHASE 1

KICK-OFF
- Objective identification
- Obtain subject knowledge
- Obtain Lenovo’s related institutional knowledge

RESEARCH
- Books
- Scientific journals
- Articles
- White papers
- Interviews with experts

TREND RESULTS
- Technology
- Intelligence and analytics
- SRM
- Change management
- Central info hub
- Paradigm shift
- Assessment tool

TECHNOLOGY
IoT, Chatbots, Natural Language Processing, Blockchain, E-Sourcing

INTELLIGENCE AND ANALYTICS
Procurement Intelligence, Big Data Analysis

PHASE 2

RESEARCH
- Books
- Scientific journals
- Articles
- White papers
- Interviews with experts

TREND RESULTS
- SRM
- Change management
- Assessment tool

CHANGE MANAGEMENT

TRANSFORMATION ASSESSMENT

SUPPLIER RELATIONSHIP MANAGEMENT
We will develop a recommended tool, software solution, or other approach for working with missing data in datasets and offer recommendations for using the tool in business development.

**PROBLEM STATEMENT**
SCS relies on client data to provide proposal and pricing for 3PL services. During this process, missing data impacts the development of competitive pricing solutions. SCS relies on assumptions about the missing data in order to fill in the gaps. The opportunity exists to increase proposal and pricing accuracy by replacing the missing data using imputation methodologies.

**PROJECT SCOPE**
Utilizing SCS raw datasets, analyze shipment, order profile, and variability trends for SCS Finished Good and Healthcare warehouse customers. From these analyses, develop a solution to impute missing data that improves order profile prediction and reduces variability in the pricing proposal process. Given the trend analyses, explore data-driven staffing.

**NC STATE TEAM**
Students: Dan Savas, Pranab Deepak, Sourabh Agrawal, Abram Rodd, Parth Gunjal; Project Advisor: Carol Kozar.

**UPS TEAM**
Brian Carrier, Adam Bibelhauser, Kristine Sanchioni
OBJECTIVES

Provide UPS with a data-driven solution for generating better price modeling inputs, enabling more competitive pricing proposals for future prospective customers and better management of costs associated with these customers.

DATA PRE-PROCESSING
Cleaned customer warehouse activity data by removing anomalies.

EXPLORATORY ANALYSIS
Generated descriptive statistics and visuals using Python libraries to understand the data.

MODELING
Organized report outputs into database on MYSQL server utilizing TIDY data process.

DASHBOARD DEVELOPMENT
Developed metrics for cost model calculations and integrated python scripts and visuals.

DASHBOARD ENHANCEMENT
Created visuals that provided meaningful insights and aided decision making.
PROJECT: IMPROVING SUPPLY CHAIN IN APPAREL

OVERVIEW
The western apparel brands such as Timberland, Wrangler managed by VF Corporation, and others, referred hereafter as brands, have either their own manufacturing units or they contract with their Tier 1 suppliers for manufacturing apparel. These Tier 1 factories sometimes subcontract their work to tier 2, 3, and 4 factories, referred hereafter as sub-tier suppliers, due to various driving factors. When the brands do not authorize this subcontracting, creates a significant risk including the risk of forced labor being utilized by these sub-tier suppliers.

SCOPE
Our target is the apparel manufacturing industry in India and Bangladesh. The team will use data and bibliography references found through research or provided by the client that maps the current situation. More data will be given if needed in the form of audit data from onsite research and interviews in India and Bangladesh.

APPAREL INDUSTRY IN INDIA

2% OF INDIA’S GDP

15% OF TOTAL EXPORTS FROM INDIA

WORLD’S 2ND LARGEST EXPORTER

THE SUPPLY CHAIN IN APPAREL

STEP 1
DESIGN - FAST FASHION

STEP 2
PRODUCTION OF TEXTILES - GROWING, SPINNING, WEAVING, AND DYEING

STEP 3
TIER ONE APPAREL MANUFACTURING - CUTTING AND SEWING

STEP 4
DISTRIBUTION AND RETAIL - TRANSPORTATION

STEP 5
END-CUSTOMER - USAGE

It is estimated that there are 45.8 million people in slavery conditions around the world - the apparel industry is pervasive and endemic in many stages of the supply chain.
APPAREL INDUSTRY IN BANGLADESH

2ND LARGEST EXPORTER OF RMG

83% OF ALL EXPORT REVENUE

20% OF BANGLADESH’S GDP

“All work or service which is exacted from any person under the threat of a penalty and for which the person has not offered himself or herself voluntarily.”

- Definition of Forced Labor
  According to ILO

LOWER TIER MANUFACTURERS

TIER 2 - INFORMAL SMALL FACTORIES

TIERS 3 AND 4 - HOME-BASED STRUCTURES

AUDIT TOOL

PURPOSE - DETERMINE THE LIKELIHOOD OF UNAUTHORIZED SUBCONTRACTING

STEP ONE
Answer a set of six questions for six categories

STEP TWO
Weight each category based on its importance

STEP THREE
Auditor notes responses and requests follow-up documentation

STEP FOUR
Responses receive risk score

STEP FIVE
Tool calculates the Total Weighted Score

STEP SIX
Results indicate risk of unauthorized subcontracting

RISK CATEGORIES
1. HIGH
2. MEDIUM
3. LOW

NC STATE TEAM
Students: Sahir Patel, Penny Kouloglou, Sultana Islam, Aayush Khandelwal;
Project Advisor: John Zapko

PARTNER TEAM
Balaji Soundararajan, Mohammed Rejaul Hasan; Advisory Member:
Robert Handfield
OUR TEAM
STAFF

Robert Handfield, PhD
Executive Director
Supply Chain Resource Cooperative
rbhandfi@ncsu.edu

Troy Pinkins, MBA
Director
Supply Chain Resource Cooperative
tjpinkin@ncsu.edu

Adam Tompkins
Content Development Specialist
Supply Chain Resource Cooperative
actompki@ncsu.edu
Our faculty leaders actively engage in the supply chain industry to increase and diversify the SCRC’s base of supporting companies. Their involvement provides an ongoing source of supply-chain information, and helps students advance through hands-on learning.

**FACULTY**

- **Tracy Freeman**  
  Professor of Practice in Operations and Supply Chain Management  
  tafreem@ncsu.edu

- **Irene Marnell**  
  Lecturer in Operations and Supply Chain Management  
  irene_marnell@ncsu.edu

- **Jeffrey Stonebraker**  
  Associate Professor of Supply Chain Management  
  jsstoneb@ncsu.edu

- **Hans Sebastian Heese**  
  Owens Distinguished Professor of Supply Chain Management  
  hsheese@ncsu.edu

- **Eda Kemahlioglu-Ziya**  
  Associate Professor of Supply Chain Management  
  ekemahl@ncsu.edu

- **Don Warsing**  
  Associate Professor of Supply Chain Operations  
  don_warsing@ncsu.edu
EXECUTIVE ADVISERS

Craig T Demarest, MBA
Executive Adviser
Supply Chain Resource Cooperative
ctdemare@ncsu.edu

Tom Donahue, BS
Executive Adviser
Supply Chain Resource Cooperative
tdonahu@ncsu.edu

Carol A Kozar, JD, MBA
Executive Adviser
Supply Chain Resource Cooperative
cakozar@ncsu.edu

Betty Minton, MBA
Executive Adviser
Supply Chain Resource Cooperative
bmminton@ncsu.edu

Walter DeGrange, M.S.
Executive Adviser
Supply Chain Resource Cooperative
wcdegran@ncsu.edu

John Glass, M.S.
Executive Adviser
Supply Chain Resource Cooperative
jwglass@ncsu.edu

John Zapko, MBA
Executive Adviser
Supply Chain Resource Cooperative
jazapko@ncsu.edu

ABOUT OUR EXECUTIVE ADVISERS

Our executive advisors have years of experience working in the supply chain industry and solving big problems through innovative means. They help industry professionals from companies like Caterpillar and Eisai become trusted advisors and cost-savings enablers. Working with our SCRC partner companies, such as Advance Auto Parts, American Red Cross, Bayer, Duke Energy, Lenovo, UNC Healthcare, RJ Reynolds, and Accenture, they lead the student practicum project teams that bring insight into the blend of academic study and practical industry experience.
BOARD OF ADVISERS

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Advanced Auto, Vice President, Supply Chain Service and Analytics

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American Red Cross, Director, Supply Chain Management Effectiveness

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Tracy Ahrens
Biogen, Business Process Optimization

Ed Donovan
Biogen

Dwight Hendrickson
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Alfredo Garcia
Caterpillar BCPD, Global Supply Chain Manager

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Marilyn Nolte
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Duke Energy, Manager, Supply Chain Operations

Will Seel
FHI, Vice President, Business Development

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John Deere - Turf and Utility Platform, Business Relationship Manager - Tractor Platform

Nicki Dillinger
Lenovo, Senior Procurement Operation Specialist

Bobby Bernard
Lenovo, Executive Director of Global Procurement

Vishnu Y Kotipalli
Lenovo, Senior Strategy Manager

Ben Matthews
Merck, Associate Director, Site Sourcing

Shakeeb Mustafa
MetLife, Director, Center of Excellence

Tracy Williams
MetLife, Business Procedures Consultant

Todd Imhoff
Restaurant Supply Chain Solutions, CPO

Kurt Collins
Restaurant Supply Chain Solutions, VP CRM

Mick Reed
VF, Senior Director, ERM

Todd Martz
XL Caitlin, Senior VP, Global Head of Strategic Sourcing and Procurement
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Seb Heese
Interim Department Head, PCOM Business Management

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Bev Porter
Director, MBA Career Management Center

Anya Reid
Executive Director, Development and External Relations

Betty Minton
Executive Practicum Advisor

Carol Kozar
Executive Practicum Advisor

Craig DeMarest
Executive Practicum Advisor

John Glass
Executive Practicum Advisor

John Zapko
Executive Practicum Advisor

Tom Donahue
Executive Practicum Advisor

Walter DeGrange
Executive Practicum Advisor

Craig Weeks
Executive Practicum Advisor

Irene Marnell
Lecturer

Tracy Freeman
Teaching Assistant Professor, Business Management and Supply Chain

Troy Pinkins
Director, Supply Chain Resource Cooperative

Robert Handfield
Professor of Supply Chain Management and Supply Chain Resource Cooperative Executive Director
PRACTICAL APPROACHES IN DEVELOPING BUSINESS ANALYTICS

The first partners meeting of the fiscal year focused on the importance of analytics in supply chain and how its role is expected to change. Dr. Rob Handfield, SCRC Executive Director, delivered a keynote address on challenges and insights related to data analytics. Then, attendees heard from data science experts.

Speakers from UPS and Lenovo gave particularly interesting presentations about how data analytics is affecting their industries, and networking breaks expanded upon these ideas, allowing for inter-industry supply chain discussions.

ROUND TABLE DISCUSSIONS

THE INTELLIGENT SUPPLY CHAIN
On January 29th, the NC State Supply Chain Resource Cooperative held a one-day workshop, bringing together executives representing a number of industries, to compare notes on how the digital transformation is occurring within their organizations. The intent of this executive forum is to bring together supply chain executives to engage in an open discussion of how analytics and AI can be used to create competitive advantage in the organization. We also shared results from the recent report completed by IBM and NC State on the current state of data analytics and Artificial Intelligence.

OUTSOURCING WAREHOUSE AND DISTRIBUTION LABOR
Supply chain leaders from nine different companies gathered with NC State MBA students, executive advisors and thought leaders on February 28th to discuss solutions to the various challenges facing the supply chain job market.

“In the current marketplace, there is a massive shortage of labor, and warehouse/labor costs are escalating,” said Dr. Robert Handfield, Executive Director of the Supply Chain Resource Cooperative (SCRC) at NC State.

Specific topics discussed at the roundtable included the emerging gig economy, how to effectively engage the millennial generation workforce, and alternative options for labor outsourcing, employment models and hiring processes. “Labor shortages within distribution and transportation are a real issue that is likely going to get worse before it gets better,” said roundtable participant Brian Vetter, the US market supply chain lead for GlaxoSmithKline (GSK).

““There is no single solution that can be deployed to address this challenge. As leaders within each of our respective organizations, we are going to need to challenge the norms and focus on how to become an employer of choice.”

- Brian Vetter, GlaxoSmithKline on Outsourcing
MARKETING AND PURCHASING COLLABORATION IN SUPPLY CHAIN
86 participants from SCRC partner companies came together on April 25 to discuss improving supplier and inter-organizational relationships. Presenters focused on correcting missteps and misunderstandings between suppliers and procurement, as well as supply chain best practices that deliver value and competitive advantage.

Following these presentations, a panel of experienced business professionals from a variety of disciplines discussed how to bring procurement, marketing, and other inter-organizational departments together to achieve better results. After the meeting, attendees enjoyed the 11th annual Leadership and Innovation showcase, which highlighted talented PCOM students and their projects.

"IT IS A TRULY A UNIQUE OPPORTUNITY THAT PROVIDES FOR THE FREE EXCHANGE IDEAS BETWEEN THE USG AND PRIVATE SECTOR. THE FEEDBACK SESSIONS FOLLOWING THE PITCHES WERE PHENOMENAL!"
- PROCUREMENT LEADERSHIP TRAINING PARTICIPANT, MAY 2019

TRAINING PROGRAM
LAUNCH OF PROCUREMENT LEADERSHIP

The Supply Chain Resource Cooperative (SCRC) partnered with NC State Executive Education to hold its first ever Procurement Leadership Training program on May 13th – 15th, which provided high-potential procurement leaders with tools and strategies needed to make dramatic improvements to their organization’s procurement practices.

17 ATTENDEES
6 COMPANIES

4.5/5 AVERAGE EXPERIENCE RATING

PARTICIPATING COMPANIES

EXPLORE PROCUREMENT IN THE DIGITAL AGE

DELIVER PROCUREMENT CHANGES WITH LASTING IMPACT
ENGAGE WITH US

THE SCRC PROFESSIONALS NEWSLETTER
The SCRC Professionals Newsletter provides supply chain professionals with curated content that they will find valuable for their professional development. The secondary/internal purpose is to promote the thought leadership of NC State Supply Chain and to create a perception of the SCRC as a source for valuable supply chain content and resources, so that readers will consider the SCRC as a potential prospect for future collaboration and partnership (if they are not already partners).

Content includes student profiles, alumni profiles, corporate partner spotlight stories, news stories about SCRC programs and workshops, student projects and accomplishments, and upcoming engagement opportunities for all audiences.

U.S. Navy Supply Corps Officer Drops Anchor in Raleigh for His MBA
For Lt. Cmdr. Will Morrison, the last two years at NC State earning his MBA have been a welcomed pit stop on his journey to the top of the ranks of the U.S. Navy Supply Corps.

 Warehouses are the Next Hot Investment Triggered by the Digital Transformation of the Supply Chain
A recent article in Warehousing suggests that warehouses are now becoming one of the hottest investments in the market, based on recent moves by the likes of Amazon and Walmart that are betting big on the shift towards e-commerce. This is a perfect example of how the physical structure of supply chains, which are often overlooked, are fundamental to understanding and enabling the digital transformation that is more and more often at the center of the business models of e-commerce companies.

The rise of Amazon and other e-commerce companies has increased the need

THE SCRC CONNECTIONS NEWSLETTER
The SCRC Connections Newsletter informs our various audiences about the work and achievements of NC State supply chain students, alumni, faculty, and corporate partners; recent events and news of said parties; and upcoming events and engagement opportunities. The newsletter’s secondary purpose is to promote the supply chain program at NC State to prospective students and partnership opportunities to potential corporate partners.

Content includes student profiles, alumni profiles, corporate partner spotlight stories, news stories about SCRC programs and workshops, student projects and accomplishments, and upcoming engagement opportunities for all audiences.

U.S. Navy Supply Corps Officer Drops Anchor in Raleigh for His MBA
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The rise of Amazon and other e-commerce companies has increased the need

2 NEWSLETTERS
21,852 PEOPLE REACHED
NC State University promotes equal opportunity and prohibits discrimination and harassment based upon one’s age, color, disability, gender identity, genetic information, national origin, race, religion, sex (including pregnancy), sexual orientation and veteran status.