Pathway to Excellence for Minority Students on Supply Chain Management and Logistics Standards through Interdisciplinary Curriculum Innovation (PEMS)

Project Final Report

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Abstract

The resilience of supply chain and logistics is becoming extremely critical under unprecedented and extra-ordinary situation, such as COVID-19 pandemic. International trade and global supply chain are vital components of the economy. Transactions within global supply chains account for over 76% of world trade. The efficiency of U.S. supply chains is a critical factor supporting the global competitiveness of the U.S. economy as a whole. The integrity and security of these supply chains are also critical national security concerns. Applying national and international standards in the design and operation of supply chain and logistics is one of the key solutions to improve its safety and resilience. Two colleges in a minority serving institution, college of engineering and college of business administration, worked together to develop a three-level interdisciplinary curriculum innovation in order to promote the education in supply chain and logistics standards and train next generation workforces, especially underrepresented minority students. Selected standards from the International Chamber of Commerce (ICC) and International Organization for Standards (ISO) were introduced to students in different levels. An interdisciplinary undergraduate minor program on supply chain and logistics standards was developed to improve undergraduate students' career readiness. In addition, an interdisciplinary graduate certificate program was developed to advance graduate students' professional preparedness on supply chain and logistics standards. Those two new programs have significantly increased business and engineering students' awareness and knowledge of supply chain and logistics standards by creating the sustainable and cost-effectiveness curriculum structures.

Project Background and Motivation

International trade and global supply chain are vital components of the economy. Since transactions within global supply chains account for over 76% of world trade [1], the resilience of supply chain and logistics is indispensable and keeps becoming extremely critical under unprecedented and extraordinary situation, such as the COVID-19 pandemic [2]. The COVID-19 pandemic has clearly

shown that the disruptions and failure of smooth supply flow caused by the lack of resilience in supply chains can impact global trade and economy. The efficiency of U.S. supply chains is a critical factor supporting the global competitiveness of the U.S. economy as a whole. The integrity and security of these supply chains are becoming critical national security concerns [3]. The modern globalized market economy makes the supply chain a way more complex network, in which not all the members are located in the same country. Under this scenario, standardized rules and regulations must be used to make the supply chain work in a more effective, efficient, and safe manner. Applying national and international standards in the design and operation of supply chain and logistics is becoming one of the key solutions to improve its safety and resilience [4]. The American National Standards Institute (ANSI) has also developed the United States Standards Strategy (USSS), which points out the need for standards' education programs as one of the high priorities [5]. There is no question about the importance of introducing standards and standardization concepts into undergraduate and graduate education. However, supply chain- and logistics- related standards normally consist of both business and engineering sides. This project built a collaborative model between college of engineering and college of business administration for promoting supply chain and logistics standards through curriculum innovation.

Traditionally, both college of engineering and college of business offer courses related to supply chain management and logistics with different focus areas, where engineering focuses on mathematical model based approaches and business focuses on management and business approaches [6]. As more and more information and communication technologies are used in supply chain management, industry and government supply chains are not simple and visible sets of links from point of origin to point of consumption [7]. Cybersecurity is becoming a critical issue and a priority area within most of global supply chain and logistics systems. While global supply chain risk management requires cooperation and collaboration among different specialty areas, it also brings new challenges for training qualified workforce [8]. As pointed out by the National Initiative for Cybersecurity Education Cybersecurity Workforce Framework (NICE Framework) [8], the future workforce in supply chain management should be familiar with both business operations and technical aspects (especially cybersecurity) of national and global supply chain and logistics systems. To better promote and teach supply chain and logistics related standards and standardization concepts, two colleges in a minority serving institution, College of Engineering and College of Business Administration, are working together to develop a three-level interdisciplinary curriculum innovation in order to promote the education in supply chain and logistics standards, as well as to train next generation workforces, especially underrepresented minority students.

Selected standards from the International Chamber of Commerce (ICC) and the International Organization for Standards (ISO) are being introduced to students in different levels, including ICC Incoterms 2020, ICC UCP 600, ISO 22301:2019 (Business continuity management system), ISO 44001 (Collaborative business relationship management systems), ISO 31000:2018 (Risk management), ISO 27001 (Information security standard), and ISO 9001. Considering the urgency and uncertainty of the current global pandemic scenario and the constant threat that this situation represents to the supply chain, a business continuity plan is of vital importance to maintain an uninterrupted supply chain and logistics system. The International Chamber of Commerce (ICC), founded in 1919, is a global organization with the objective of setting global standards for business. ICC Incoterms is an acknowledged worldwide contractual standard that was originally drafted in 1936 to facilitate the interpretation of international terms of trade. ICC Incoterms is updated regularly

(generally every ten years, the latest version is 2020) in order to address the changing business environment. ICC Incoterms 2020 has 11 different terms, divided by transportation mode, which deal with issues such as who will deliver, how it will be deliver, where would it be delivered, who pays what, who loads, who unloads, who assumes the risk and until when, when the possession of the goods is transferred, who deals with the export and import processes, etc. ICC Uniform Customs & Practice for Documentary Credits (UCP 600) is another standardized set of rules, which in company of the ICC Incoterms 2020, helps the flows in the supply chain to be faster and smoother. ICC UCP 600 mainly deals with one of the flows managed by the supply chain: money, specifically documentary credits. The ICC UCP was originally drafted in 1933 to help businesses handle trade and payment, which handles issues such as how the payment will take place, when it will take place, types of credits, roles of the banks involved, etc.

Program and Course Design

This ongoing collaborative project started on October 2020. Figure 1 shows the overall structure design of this collaborative project. First, entry level course modules are developed, and has been used in current freshman introduction to engineering and business courses to increase students' awareness on standards. Second, an interdisciplinary undergraduate minor program on supply chain management (SCM) and logistics standards has been created with an aim to improve undergraduate students' career readiness. At last, an interdisciplinary graduate certificate program will be developed to advance graduate students' professional preparedness on supply chain and logistics standards. The undergraduate course modules are closely tied to ABET and AACSB accreditation criteria and student learning outcomes. The details of the program and course design are discussed below.

Entry-level modules are designed for freshman students with little to no knowledge about SCM and logistics. The entry level modules introduce concepts and standards about supply chain, and briefly explain the ICC standards and ISO 22301. These modules cover background information and relevance of the standards, as well as their applicability to manage the supply chain. These course modules will be introduced into the freshman courses: UNIV 1101- Learning in Global Context I (Business and Pre-engineering sections), and GEEN 1201- Engineering as a Career (Engineering majors). Due to the limitation on available class time, the entry level modules are only designed for 3 hours lecture time. Upon completion of the module, it is expected that students will be able to:
(a) understand the importance of standards in the supply chain, and
(b) recall some of the basic standardized terms widely used internationally in the logistics arena.

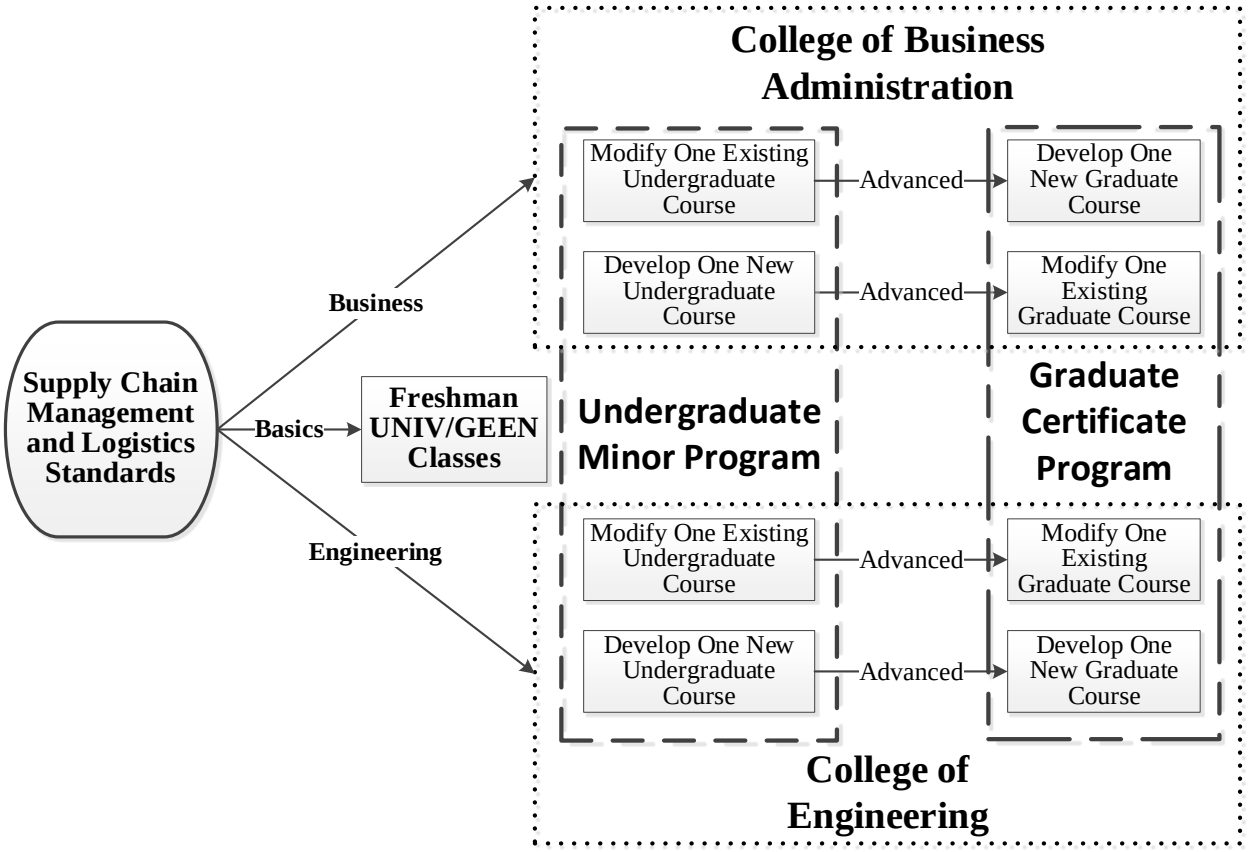

Figure 1: Overall Structure Design of the Program.

The interdisciplinary undergraduate minor program on SCM and logistics standards was developed and approved in Spring 2021 and was added to Texas A&M University – Kingsville undergraduate catalog in Fall 2021 and it requires a total of 18 credit hours courses, includes two new courses and two revamped existing courses that focus on introducing the ICC and ISO standards. Lectures, assignments and culminating hands-on projects are used in the courses to explain, compare, contrast and apply the following standards: ICC Incoterms 2020, ICC UCP 600, ISO 44001:2017, ISO 31000:2018, ISO 22301:2019, ISO 9001:2015, and ISO 27001. The student learning outcomes of the new minor program are that students should also be able to:
(a) understand the structures of the introduced standards and other related standards;
(b) discuss the benefits of implementing the standards in supply chain management;
(c) use standards to evaluate and improve a SCM system;
(d) to identify the key success factors for the development of collaborative business relationships; and
(e) to relate and map the requirements/stages needed for the development and management of successful collaborative relationships
This minor program will retain and continue to be offered after the ending of the grant period. The description of the program in the university catalog is:
"Supply Chain Standards" minor (18 hours)
Students are required to complete three of the following courses with C or better:
IEEN 4313 Standards in Supply Chain;

IEEN 4332 Principles of Engr. Management;
MKTG 4345 Contracts and Documentation;
MGMT 4358 Lean Operations.

Students also need complete three of the following courses with C or better:
IEEN 3321 Op. Research Meth. In Engr. I; IEEN 3325 Engr. Economic Analysis I; IEEN 4321 Op. Research Meth. In Engr. II; IEEN 4325 Engr. Economic Analysis II; MGMT 3355 Operations, Logistics and Supply Chain Management; MKTG 3330 Transportation; MKTG 3375 Warehouse and Inventory Management; MKTG 4335 Supply Chain Management; or BAUD 3366 – Introduction to Business Intelligence.

The graduate certificate program on supply chain management and logistics standards, which requires 9 credit hours of courses, has been developed and approved in Spring 2022 and it was designed to teach graduate students and industry professionals to apply standards and standardization as powerful analytic tools. Students need to complete two required courses, MKTG 5320-Logistics and chain management and IEEN 5303-Advanced risk management and cybersecurity standards in logistics. Students also need to complete one of the two electives, MKTG 5303-Responsive supply chain or IEEN 5312-Supply chain management. Through experience-based learning activities, students will develop the skills needed to thrive in their future careers. The three-course structure, same as the existing graduate manufacturing standard and standardization certificate program [9]-[10], will allow full time students to complete it in one regular semester. The new certificate program will focus on ICC Incoterms 2020, ISO 31000 and ISO 27001. The student learning outcomes are that students should be able to:
(a) correctly apply the ICC standards;
(b) identify the risks in a supply chain;
(b) evaluate an information security system; and
(c) improve a logistics system.

Table 1: Summary of Courses and Related Standards

Freshman Courses	
Course type and name	**Standards to be covered**
UNIV 1101- Learning in global context I (Business and Pre-engineering) / GEEN 1201- Engineering as a career (Eng.)	ICC Incoterm 2020 Introduction ICC UCP 600 Introduction
Upper Level Undergraduate Courses involved in the minor program	
Course type and name	**Standards to be covered**
New (Business): MKTG 4345-Contracts and documentation	ICC Incoterm 2020 and ICC UCP 600
New (Eng.): IEEN 4313-Standards in Supply Chain	ISO 31000:2018 Risk management ISO 27001 Information security standard
Revamped (Business): MGTM 4358-Lean operations	ISO 44001 Collaborative business relationship management systems
Revamped (Eng.): IEEN 4332-Principles of Engr. Management	ISO 22301:2019 Business continuity management systems and ISO 9001
Graduate Courses involved in the certificate program	

Course type and name	Standards to be covered
Revamped (Business): MKTG 5320-Logistics and SCM	ICC Incoterm 2020 and ICC UCP 600
New (Eng.): IEEN 5303-Standards of Cybersecurity in Supply Chain and Logistics	ISO 31000:2018 Risk management ISO 27001 Information security standard
New (Business): MKTG 5310-Negotiations	ISO 44001 Collaborative business relationship management systems
Revamped (Eng.): IEEN 5334-Lean Manufacturing	ISO 44001 and ISO 22301:2019

Project Accomplishments and Challenges

Through some workshops and student advising, the new courses offered by this project has attached great number of students. The enrollment data is listed in the following table:

	Summer 2021	Fall 2021	Spring 2022	Fall 2022	Spring 2023	Fall 2023
MKTG 4345 Contracts and Documentation	1					
MGMT 3355 Logistics and SCM	31	28	16	38	28	15
MKTG 4335 Supply Chain Management		13		10		15
MGMT 4358 Lean Operations			31		14	
IEEN 4312 Supply Chain Management				2		2
IEEN 4332 Principle of Engineering Management				3		2
MKTG 5320 Logistics and SCM	15	9	5		10	10
IEEN 5303 Standards of Cybersecurity in Supply Chain	10					9
IEEN 5312 Supply Chain Management		20		21		13
IEEN 5313 Inventory Systems	9		12		14	

During the grant period, we were also able to offer four NIST Webinars to summer research students and faculty and many of them are from other universities. NIST program manager also gave our students an in person seminar during their visit in March 2023. Many thanks to these fantastic speakers from NIST for their support and great presentations. The project team also gave a presentation based on this project on 2022 ASEE GSW conference. We were also able to use the

grant to support two doctorial students and one master student on their standard related research work. We also promoted the new programs we developed and increased the impacts of the project on high school and community college students through engineering information night and other recruiting events.

In conclusion we have successfully completed the activities we proposed and achieved the goals of this granted project. We are going to continue to promote the new minor and certificate programs we developed, offer the related courses, and conduct research on supply chain management related standards even after the grant is ended.

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