3-24-2016

Consolidating Supply Chain Management Education Through Professional Certification

Christopher L. Clawson

Consolidating Supply Chain Management Education Through Professional Certification

THESIS

Christopher L. Clawson, Captain, USAF

AFIT-ENS-MS-16-M-096

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT-ENS-MS-16-M-096

CONSOLIDATING SUPPLY CHAIN MANAGEMENT EDUCATION THROUGH PROFESSIONAL CERTIFICATION

THESIS

Presented to the Faculty

Department of Operational Sciences

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics and Supply Chain Management

Christopher L. Clawson, BS

Captain, USAF

March 2016

AFIT-ENS-MS-16-M-096

CONSOLIDATING SUPPLY CHAIN MANAGEMENT EDUCATION THROUGH PROFESSIONAL CERTIFICATION

Christopher L. Clawson, BS
Captain, USAF

Committee Membership:

Kenneth Schultz, PhD
Co-Chair

Lt Col Joseph Huscroft
Co-Chair

Abstract

The Air Force and Department of Defense can benefit from professional certification in supply chain management. Research addressed the benefits and impact certification can have on individuals and an organization. Without a defined and concise education plan for supply chain management, certification remains a viable option. Interviews with defense industry partners highlighted key aspects of successful SCM development and education programs.

To all those who have supported and helped me through this journey

Table of Contents

List of Figures

Page

List of Tables

Page

CONSOLIDATING SUPPLY CHAIN MANAGEMENT EDUCATION THROUGH PROFESSIONAL CERTIFICATION

I. Introduction

The Air Force needs better educated supply chain managers. Professional certification in supply chain management (SCM) offers one appropriate method. The research looked at available programs, both those commercially available and similar Air Force options. Interviews from defense industry partners provided insight into better business practices. The researcher developed various courses of action to deliver the best future options for SCM expertise. The researcher recommends a trial program using existing civilian certification programs.

Chapter Overview

To provide for the nation's defense, the United States Air Force should look at all manner of technologies and practices to adequately prepare for future conflicts. As current education may focus on maintenance operations or logistics functions, the Air Force needs revolutionary education to change, update, and modernize SCM. Research focused on certification programs as the primary method.

Target Population

This research focused specifically on the applicability of SCM certification to Air Force logistics officers. Logistics officers comprise the majority of officers working on the operation and maintenance part of the supply chain. As procurement and acquisition

are a separate specialty area of the Air Force, those career fields like program manager were not considered. The term "logistics officer" is separated into Aircraft Maintenance (21A), Ammunition Maintenance (21M), and Logistics Readiness (21R). By commissioning as an officer, all members have graduated from an undergraduate institution and serve on active duty in the Air Force. Recommendations and possible application of certification to the civilian members of the Air Force are described later in the Analysis and Results, but a separate office manages civilian career development. Separating the Air Force workforce into similar subgroups allowed proper analysis based on the hiring or accession requirements for the different groups. At the higher levels of enterprise, officers may not have the necessary background or understanding in SCM specialties. Potential positions are not strictly consolidated to depot level maintenance bases or regional warehouses. With the amount, volume, and price of parts and equipment purchased, the Air Force looks to develop a holistic focus on SCM, bridging a knowledge or skills gap with professional certification.

Rationale

The Air Force needs SCM leaders educated in the field. In some regards, the Air Force acts like many companies in the corporate world. It must buy products, goods and services provided by firms, build relationships and work with companies over decades, and evaluate a diminishing base of suppliers. With the rapid flow of information and the interconnectedness of companies, many large firms have moved toward SCM to reduce costs or secure a competitive edge. While terms like procurement, logistics, purchasing, transportation, and warehousing are still used, many firms established consolidated SCM

offices or work centers. How a company interacts with and uses its suppliers can have a significant impact on production operations and subsequently customers. Firms did not adopt SCM, Just in Time, or Total Quality Management ideas to make themselves feel good. These principles and methods lead to higher quality products, better production, or reduced costs, all directly benefiting the firm. Just as other companies reaped the benefits of SCM, the Air Force could also expect results following similar paths. The ideas and management methods are implemented by people knowledgeable in the subject, hence the focus on education in SCM versus just implementing new processes.

The Air Force owns and operates an extremely large aircraft fleet, approximately 5,000 individual aircraft. Significant investments in people, support equipment, and parts must be made to ensure continued aircraft availability and operational success. As one of the Air Force's core missions, Rapid Global Mobility necessitates the use of aircraft and supporting organizations. Functions like maintenance and logistics ensure aircraft and parts are available to meet the Air Force's missions through a weapon system's lifespan. As such, the Air Force faces costs not only with procurement and weapon system development, but also through the life cycle with overhauls and other maintenance actions.

As shown in Figure 1, the Air Force spent almost $138 billion in Fiscal Year 2014, with almost $45 billion allocated specifically for operation and maintenance (O&M). By realizing just a one percent cost reduction in O&M, the Air Force could save about $450 million. Arguably, procurement and research development could also play into SCM, further increasing potential savings from SCM efficiencies. If the services

already buy items at the lowest cost or best value, future savings must come from improved processes or efficiencies though SCM.

FY15 President's Budget Facts			
	FY14 Enacted	FY15 PB	Delta
Total Air Force ($M)	**138,272**	**137,900**	**(372)**
Blue TOA	108,742	109,341	599
Operation and Maintenance (O&M) [1]	44,958	44,341	(617)
Military Personnel (MILPERS)	29,238	29,110	(127)
Military Construction (MILCON)	1,218	956	(262)
Military Family Housing	461	328	(134)
Procurement	16,768	18,544	1,775
Research Development Test & Evaluation (RDT&E)	15,973	15,972	(1)
Base Realignment and Closure (BRAC)	126	91	(35)
Non-Blue TOA	29,529	28,558	(971)

Figure 1. 2015 Air Force Budget (SAF/FMB, 2014, pBH4)

The end result of certification should be higher-quality education to build effective SCM professionals within the Air Force, at the same or lower cost. A solution exists with civilian certification agencies or an Air Force-developed program, building on initial certification with continuing education requirements.

Problem Statement

Professional certification affords one method to meet SCM education needs. Agencies like APICS, the International Society of Logistics (SOLE), and Council of Supply Chain Management Professionals (CSCMP) offers specific certifications in the SCM area. Most officers in the logistics career field do not have educational backgrounds in logistics or SCM. Furthermore, sending the target number of officers for graduate degrees in SCM becomes cost prohibitive. Certification takes educational

attainment into consideration but also requires work experience. Drawing from the target population of officers, certification falls just in the right place as an alternative to graduate education.

The Air Force needs a consolidated, coherent process to educate logistics readiness and maintenance officers in SCM. By current descriptions, neither the logistics readiness nor aircraft maintenance officers have SCM included as operational areas or specific tasks (United States Air Force, 2015). Currently, the Air Force spends about $180,000 annually to educate logistics officers in SCM through various initiatives, mostly certificate classes at various educational or corporate entities. This comes after the initial and intermediate education courses already provided by the military for the respective officers in logistics or maintenance. Considering the 21X designated logistics career fields, initial job education does not have a specific block of material related to SCM. Logistics Readiness officers study topics like transportation, warehousing and fuel management; Aircraft Maintenance officers cover scheduling, aircraft systems and repair, and some reverse logistics. While the DoD does have a joint directive establishing the procedures and processes for SCM, the Air Force may not have a codified document detailing how to nurture and grown SCM professionals.

Purpose of Study

This study provides a critical analysis regarding current education methods compared to alternative programs like professional certification. Certification offers several personally beneficial factors including increased competence, confidence, and prestige with others inside or outside the field. On the corporate side, certification

garners public prestige, allows outsourcing of specific education, and presents external standards. Limiting the scope, current education remains the baseline, with various professional certification programs being compared against each other, along with an Air Force run option. The decision analysis compares four options including: further study of specific SCM shortfalls, a trial period using civilian-run certification programs, an Air Force-developed initiative, continuing current efforts, or possibly some combination of the previous options. Without knowing if professional certification would fulfill the anticipated knowledge gaps, a trial period with existing certification programs presents the best option.

Research Questions

1. What are the advantages of Air Force officers having some form of certification?
2. What criteria should be used to evaluate alternative certification options?
3. Which option/alternative is the best?

Assumptions

Multiple assumptions were made to specify the appropriate scope. The primary assumption implies professional certification provides a higher degree of subject material retention versus certificate programs, hence the main reason for addressing a new option. Certification will be targeted for officers with six to nine years of service, eliminating the need to consider undergraduate education. Cost was a significant factor when comparing alternatives but not absolute; the cheapest approach would provide no education. Either a new method will be adopted, or validation of current efforts to remain in place. An option of doing nothing will not be considered. As a force initiative, certification exams would

be paid for, moving away from discussions on personal valuation of certification and individual constraints. Demands on officers will be for study and preparation time, along with any continuing education requirements. If the best option is not feasible for various reasons, a sliding scale approach will be used. For example, the best option to educate 200 officers might cost too much, but 100 officers could be educated at an acceptable cost.

Summary

Professional certification for SCM individuals could grant a greater benefit to the Air Force than current education programs. Moreover, various documents and directives from senior Air Force and DoD leadership support professional certification. A knowledge gap appears to stem from the lack of a coherent SCM education process. Also, most officers in the logistics field do not have an educational background related to SCM. The literature review focuses on source documents stating the drive from professional certification, lack of knowledge in SCM, and professional certification programs in general.

II. Literature Review

Chapter Overview

To better understand the full implications of certification, I examined SCM as a field and applicable reasons for certification. With the growth and expansion of SCM, many researchers provided various definitions for SCM. Going from the DoD definition for SCM, the paper addresses applicable shortfalls in recruitment and development of logistics officer, as pertaining to SCM. As certification represents a method to improve performance, reviewing literature from other areas of study yielded elements common throughout certification programs. The researcher considered both benefits and counter arguments to certification. Specific elements of certification segregate programs for consideration. Finally, appropriate elements for selection criteria and decision-making methodologies provided scrutiny for the selection process.

Supply Chain Management Definition

Analysis on SCM certification requires a definition of SCM. Definitions convey a specific meaning for a term or concept. More importantly, a definition for SCM should help delineate applicable activities or topics a SCM certification should cover.

There is not a generally agreed-upon definition for SCM. Many researchers in the discipline have proposed definitions for the term. Multiple definitions and varying research lines complicate communication. Figure 2 includes several prominent definitions of SCM existing in 2001 as reference. "Cooper, Lambert, and Pahn (1997) provided a valuable review of 13 early SCM definitions [and] a solid argument that SCM

and logistics are not identical" (Gibson, Mentzer & Cook, 2005, p17-18). Stock and Boyer (2009) discerned 173 unique definitions of SCM identified from published sources through 2008.

DEFINITIONS OF SUPPLY CHAIN MANAGEMENT

Monczka, Trent, and Handfield (1998)	SCM requires traditionally separate materials functions to report to an executive responsible for coordinating the entire materials process, and also requires joint relationships with suppliers across multiple tiers. SCM is a concept, "whose primary objective is to integrate and manage the sourcing, flow, and control of materials using a total systems perspective across multiple functions and multiple tiers of suppliers."
La Londe and Masters (1994)	Supply chain strategy includes: "... two or more firms in a supply chain entering into a long-term agreement; ... the development of trust and commitment to the relationship; ... the integration of logistics activities involving the sharing of demand and sales data; ... the potential for a shift in the locus of control of the logistics process."
Stevens (1989)	"The objective of managing the supply chain is to synchronize the requirements of the customer with the flow of materials from suppliers in order to effect a balance between what are often seen as conflicting goals of high customer service, low inventory management, and low unit cost."
Houlihan (1988)	Differences between supply chain management and classical materials and manufacturing control: "1) The supply chain is viewed as a single process. Responsibility for the various segments in the chain is not fragmented and relegated to functional areas such as manufacturing, purchasing, distribution, and sales. 2) Supply chain management calls for, and in the end depends on, strategic decision making. "Supply" is a shared objective of practically every function in the chain and is of particular strategic significance because of its impact on overall costs and market share. 3) Supply chain management calls for a different perspective on inventories which are used as a balancing mechanism of last, not first, resort. 4) A new approach to systems is required—integration rather than interfacing."
Jones and Riley (1985)	"Supply chain management deals with the total flow of materials from suppliers through end users..."
Cooper et al. (1997)	Supply chain management is "... an integrative philosophy to manage the total flow of a distribution channel from supplier to the ultimate user."

Figure 2. Definitions of Supply Chain Management (Mentzer, et al., 2001, p6)

SCM definitions share similarities based on a process, discipline, philosophy, governance structure, or functional area perspectives, and the above perspectives came from 37 articles representing the top 100 cited articles published in scholarly journals (Ellram and Cooper, 2014). Bechtel and Jayaram (1997) proposed five schools of thought for SCM with definitions at the time. Figure 3 shows their table summarizing the schools' and respective researchers' definitions. The different perspectives and schools of thought help partition definitions in the SCM field.

Supply Chain Schools of Thought

Author(s)	Definition
	Chain Awareness School
Jones and Riley (1985)	"Supply chain management deals with the total flow of materials from suppliers through end users." (p. 19)
Houlihan (1988)	"Supply chain management covers the flow of goods from supplier through manufacturer and distributor to the end user." (p. 14)
Langley and Holcomb (1991)	"Supply chain management focuses attention on the interactions of channel members to produce an end product/service that will provide best comparative value for the end user." (p. 14)
Cavinato (1991)	"… the entire sourcing, value-added, and marketing activities of the overall link of firm up to final customers." (p. 32)
Novack and Simco (1991)	"Supply chain management covers the flow of goods from the supplier through the manufacturer and distributor to the end user." (p. 32)
Stevens (1990)	"Control the flow of material from suppliers, through the value adding (production) processes and distribution channels, to customers."
Lee and Billington (1992)	"Networks of manufacturing and distribution sites that procure raw materials, transform them into intermediate and finished products, and distribute the finished products to customers." (p. 65)
	Linkage/Logistics School
Scott and Westbrook (1992)	"…supply chain is used to refer to the chain linking each element of the production and supply process from raw materials through to the end customer." (p. 23)
Turner (1993)	"…technique that looks at all the links in the chain from raw materials suppliers through various levels of manufacturing to warehousing and distribution to the final customer." (p. 52)
	Information School
Johannson (1994)	"SCM is really an operations approach to procurement. It requires all participants of the supply chain to be properly informed. With SCM, the linkage and information flow between various members of the supply chain are critical to overall performance."
Towill, Naim and Wikner (1992)	"A supply chain is a system, the constituent parts of which include material suppliers, production facilities, distribution services, customers linked together via the feed forward of materials and the feedback flow of information." (p. 3)
Manrodt and Harrington (1995)	"Product and information flow encompassing all parties beginning with the supplier's suppliers and ending with customers or consumers/end users… flows are bidirectional."
	Integration School
Cooper and Ellram (1990)	"An integrative philosophy to manage the total flow of a distribution channel from the supplier to the ultimate user." (p.1)
Ellram and Cooper (1993)	"Supply chain management is an approach whereby the entire network from which suppliers through the ultimate customer, is analyzed and managed in order to achieve the 'best' outcome for the whole system." (p.1)
Hewitt (1992)	"Supply chain integration is only a natural result of redesigned business processes not realignment of existing functional organizations." (p.340)
	Future
Cavinato (1992)	"The supply chain concept consists of actively managed channels of procurement and distribution. It is the group of firms that add value along product flow from original raw materials to final customer. It concentrates on relational factors rather than transactional ones." (p. 285)
Farmer (1995)	"Instead of using the term supply chain management, we should use the idea of a seamless demand pipeline."

Figure 3. Supply Chain Schools of Thought (Bechtel and Jayaram, 1997, p17)

Despite its simplicity by comparison, the DoD definition of SCM is utilized for this research. "Supply chain management [is] a cross-functional approach to procuring, production, and delivering products and services to customers" (Joint Publication 1-02, 2010, p228). As the researcher focused on certification applied to Air Force officers, the

military interpretation of SCM seemed most appropriate. Other important governing documents related to DoD SCM are DoD Instruction 4140.01 (Defense Acquisition University, 2016) and the DoD Supply Chain Implementation Guide. The DoD definition exempts supplier importance and the importance of information flow from SCM. Similarities exist with the cross functional basis, areas and activities within SCM, and end customer focus. Using a stated definition of SCM allows equal comparison of alternative certification programs.

The definition provides a governing framework, but certifications test on specific areas and topics of SCM. As the DoD SCM definition does not include a very extensive list, the researcher used Workforce Category Technical Competencies as targeted areas of material. Figure 4 provides 15 topics that potential certification programs should cover. No better list of activities or topics areas in SCM could be found than the Workforce Category Technical Competencies.

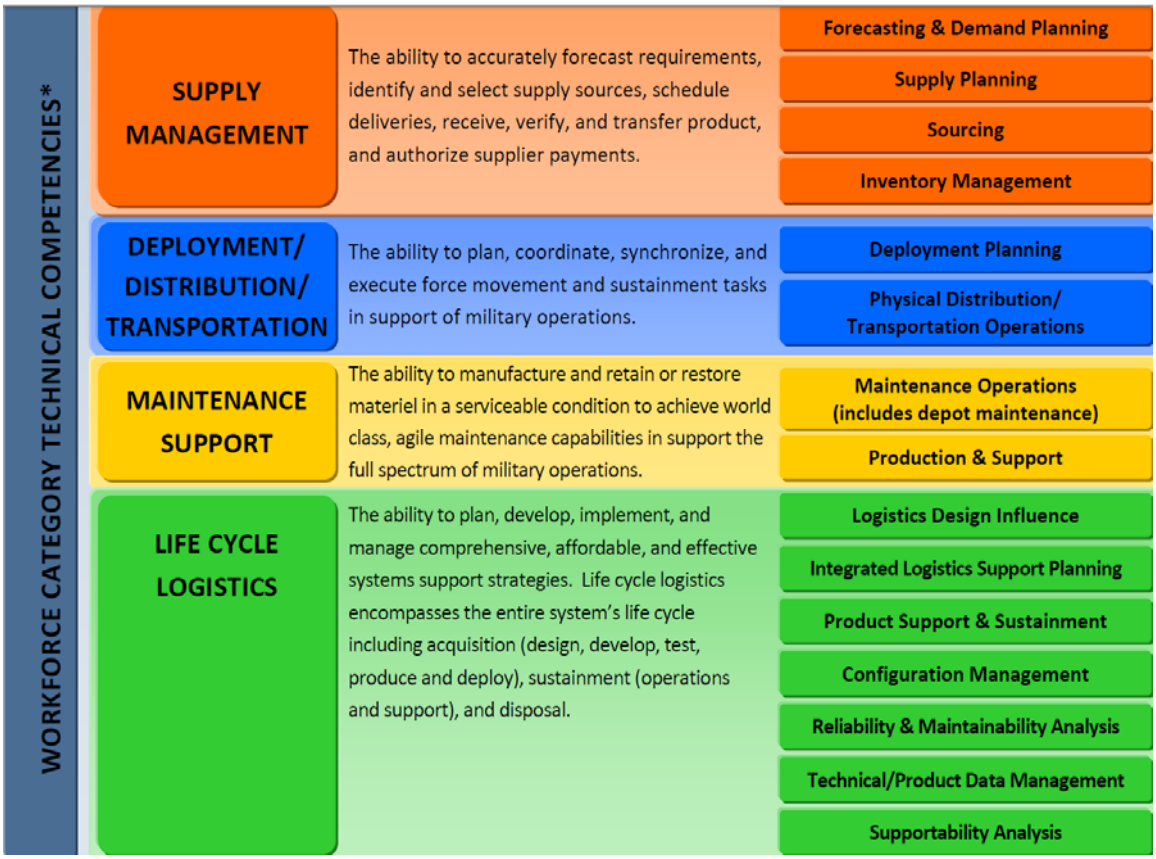

Figure 4. Workforce Category Technical Competencies (Office of the Secretary of Defense, Logistics & Materiel Readiness, 2008, p6)

Why to Consider Certification

Current and future education needs stem from several key issues, including lack of educational background; individual behavior or motivation; and unclear development goals. Development of a world-class and competitive Air Force enterprise requires personnel knowledgeable in SCM. New initiatives and improvements necessitate a coherent and thoughtful approach. While the DoD does have a joint directive establishing the procedures and processes for SCM, the Air Force may not have a codified document detailing how to nurture and grown SCM professionals.

The logistics career field does not have any barriers to entry like other specialties. All officers require an undergraduate degree before being commissioned. To be a civil engineer in the Air Force, officers must have the required academic degree specialty in civil engineering or other appropriate field. While the Air Force does try to place new accessions into the best careers, undergraduate degree specialty has not been a primary selection criterion. A relatively low percentage of officers in the logistics area hold a formal undergraduate degree in logistics or SCM. While officers are encouraged to get advanced degrees, only a small percentage earns degrees in a logistics or SCM related field. The Air Force educates officers but does not require specific degrees for placement into the logistics career fields.

The majority of logistics officers do not have degrees in logistics or other SCM functions. Appendix A contains a list of 1312 records, showing the education degrees earned by Majors and Lieutenant Colonels in the logistics career field. Data came from the 21R Education & Training (A4LR) section located at the Pentagon. The researcher used Air Force Institute of Technology (AFIT) academic codes to determine programs appropriate to logistics or SCM, found at http://www.afit.edu/CODING/studyareas.cfm. 22 codes incorporated SCM or logistics programs including: 1ACA, 1ACB, 1ACX, 1ACY, 1AKD, 1AKG, 1AKJ, 1AKY, 1AMA, 1AMC, 1AMG, 1AMJ, 1AMM, 1AMS, 1AMX, 1AMY, 1ANC, 1ATD, 1ATK, 1ATY, 1CBC, and 1CBF. Approximately 217 individuals had an educational background in SCM or logistics, representing 16.5%. Of those 217, about 137 of the degrees were awarded from the AFIT. Figure 5 provides a pie chart of total numbers for AFIT degrees, SCM or logistics degrees, and other degrees.

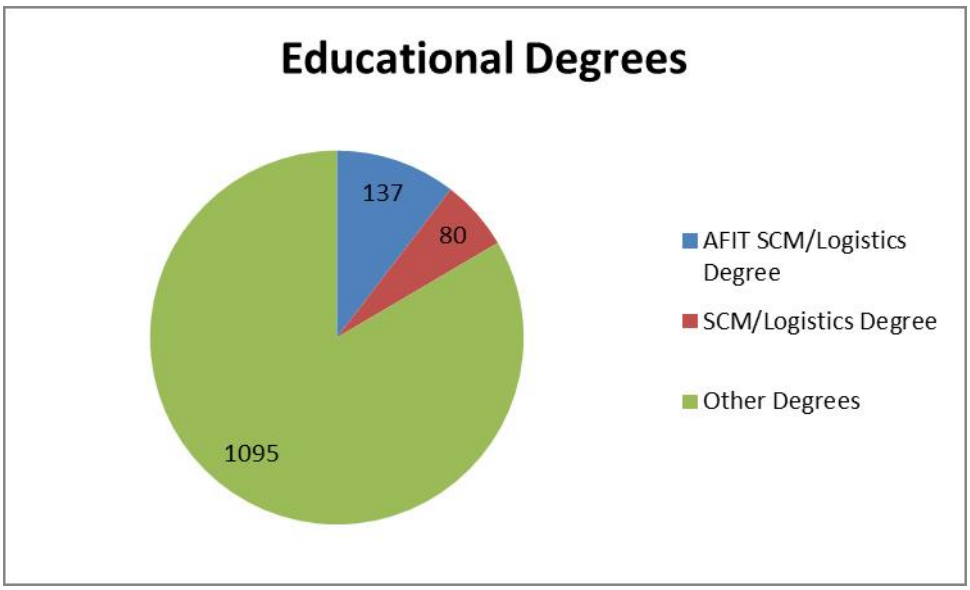

Figure 5. Logistic Officer Educational Degrees

The career field cannot control what educational focus officers get advanced degrees in using tuition assistance. Advanced degrees are encouraged for all officers. However, tuition assistance comes from the Department of the Air Force or Veterans Affairs, not the logistics career field.

> "Active duty personnel can pursue voluntary, off-duty educational opportunities with assistance from the Air Force Tuition Assistance (TA) program. Currently, the program pays 100 percent (up to $250 per semester hour or equivalent) of the cost of college tuition with a limit of $4,500 per fiscal year. Courses and degree programs may be academic or technical and can be taken from two- or four-year institutions on base, off base or by correspondence." (United States Air Force, 2016).

As an education program, sending the required number of officers for master's degrees in SCM would not be cost effective. Individuals can choose what academic programs to pursue with TA, but TA does not cover concurrent degrees. If an officer already holds a master's degree, TA will not be awarded from master's level college educations.

Logistics officers cannot be penalized for getting educational degrees outside SCM or logistics.

Unclear development goals impact officer development. With individual behavior and motivation, the career field has limited control over individual decisions regarding personal matters. Without the set development plan for SCM individuals, officers currently receive ad hoc education when entering an SCM position. Unlike some corporations, the Air Force does not post hiring requirements for SCM positions with the necessary specific, educational background. Instead, attempts are made to grow SCM specialists from within. In comparison to commensurate civilian government positions in SCM, the Air Force does not required professional certification for civilian employees. Currently, education efforts in SCM were designed to bridge the knowledge and performance gaps above, but professional certification could also provide similar results.

Certification in the military is not a new concept, as other career fields have existing certification programs or recognize certification. Specifically, the financial management community and civil engineers address certification in career development and job progression.

Elements of Certification

As this research focuses on better education through professional certification, the programs considered must fall in the appropriate realm. Although numerous options and programs exist to educate individuals on SCM, only a handful would potentially meet the higher requirements of certification over a certificate program. Not specific only to logistics or SCM, professional certification remains a term found throughout other

disciplines. Also as the focus falls on individual education, certification of suppliers or processes will not addressed in this paper. Professional experience, a comprehensive exam, and continuing education appeared as common elements of professional certification across several disciplines and areas of study (Adams, Brauer, Karas, Bresnahan, & Murphy, 2004; Dion, 2013; Ewert & Kominski, 2014; Hall & Mitchell, 2010; Remer & Ross, 2014; Schaffer, Crawford & Moss, 2012; Smallfied, 2013).

Professional Experience and Educational Foundation

While a plethora of programs such as job skills training exists, professional certification usually involves individuals with previous experience in the field. Depending on the discipline and certifying body, some combination of professional experience and education must be reached. For example, an individual should possess a bachelor's degree with five years experience or a master's degree with three years experience. One important distinction considered was the requirement of specific degrees to enter a given field, such as nursing or law.

Cumulative or Extensive Knowledge Exam

The cumulative exam assesses an individual's comprehension and retention of subject matter and knowledge, probably the most important part of certification from a competency perspective. While some certificate programs do administer an end-of-class exam, the mere completion of a course without any required testing leaves something to be desired. Some companies prefer certifications when hiring employees for this reason. Passing the cumulative exam gives some measure of success and expectation on an individual's baseline knowledge in the given area. In some ways, holding a certification becomes a discriminator when hiring, similar to job applicants who hold an

undergraduate degree from an accredited university. Figure 5 gives a working definition for certification compared to educational certificates.

Working Definitions of Non-Degree Credentials

GEMEnA has developed the following working definitions of industry-recognized certifications, occupational licenses, and educational certificates. To maintain consistency with federal statistical data, GEMEnA encourages those who collect information on the attainment of these credentials to align such collections with these definitions. To the extent that these definitions are used as the basis for legislation, regulation, accountability systems, and administrative data systems, users will be able to compare results to nationally-representative data.

Certification: A credential awarded by a certification body based on an individual demonstrating through an examination process that he or she has acquired the designated knowledge, skills, and abilities to perform a specific job. The examination can be either written, oral, or performance-based. Certification is a time-limited credential that is renewed through a recertification process.

License: A credential awarded by a government agency that constitutes legal authority to do a specific job. Licenses are based on some combination of degree or certificate attainment, certifications, assessments, or work experience; are time-limited; and must be renewed periodically.

Educational certificate: A credential awarded by an educational institution based on completion of all requirements for a program of study, including coursework and test or other performance evaluations. Certificates are typically awarded for life (like a degree). Certificates of attendance or participation in a short-term training (e.g., 1 day) are not in the definitional scope for educational certificates.

Figure 6. Working Definition of Non-Degree Credentials (National Center for Education Statistics, 2013)

Continuing Education Requirements

Although certification has been compared to undergraduate degrees, a stark difference between the two comes with continuing education. Most students, upon completing a bachelor's degree might, start a job, learning on-the-job skills and specific tasks useful to their specific company. Certification does not stop when the individual passes the exam; moreover, the continuing education part of certification looks to further develop and expose the individual over subsequent years. Conference attendances, writing papers, taking classes, and other options routinely bring important and emerging ideas of SCM to the individual. Also compared to most educational certificates,

certifications expire after a set amount of time, normally three to five years depending on the organization. The continuing education requirement comes with recertification, validating continued participation in the field and relevance--even years after the initial exam.

Unfortunately, unlike other fields, logistics and SCM do not have one universally recognized certification agency or program, let alone a specific title. Most people filing taxes have probably heard of a Certified Public Accountant (CPA), but some civilian companies seek a specific or similar certification in the area of logistics and SCM.

Reasons for Certification

Reasons for the Air Force to consider professional certification fall into four main areas including: reports and guiding documents, personal expectations, corporate benefits, and counter support. The literature came from across the spectrum of fields involved with certification, like medical, education, government, and business.

Personal Expectations

Looking at associated literature, individuals pursue professional certification mostly for an increased knowledge base or competence, prestige with others in similar or different fields, feeling more professional, confidence/personal empowerment, as a job credential, increased salary, legal requirements, or commitment to a profession.

1. Knowledge base and competence exceeds most other personal reasons for certification. As a framework, this reason for certification covers an increase in personal comprehension and understanding of topics within the given field of study (Adams, Brauer, Karas, Bresnahan, & Murphy, 2004; Davis & Rubin, 1976; Ewert &

Kominski, 2012; Fawcett & Rutner, 2014; Gorbell, 2006; Hall & Mitchell, 2010; Lipner, Hess & Phillips, 2013; Lummus, 2006; Phillips, 2004; Prier, McCue, & Behara, 2010; Prowant, Niebuhr, & Biel, 2007; Thomchick & Humphrey, 1996; Williams, Lopez, & Lewis, 2013). Of note, this reason weighed very heavy for personal expectations in the medical fields.

2. Prestige with others in or outside field concerned the satisfaction or sense of accomplishment derived from peers (Adams, Brauer, Karas, Bresnahan, & Murphy, 2004; Blalock, 2012; Davis & Rubin, 1976; Fawcett & Rutner, 2014; Hall & Mitchell, 2010; Lipner, Hess & Phillips, 2013; Lummus, 2006; Prowant, Niebuhr, & Biel, 2007; Thomchick & Humphrey, 1996). Most people are social creatures and want a sense of belonging with those around them. To some degree, individuals earned a professional certification to garner positive acknoledgement from peers or others interacted with during work.
3. Felling more professional deals with personal feelings associated with being a professional (Davis & Rubin, 1976; Prowant, Niebuhr, & Biel, 2007). This item could be closely linked to prestige with others and confidence, but it was listed as a separate reason. Felling like a professional might also stem from middle management workers earning certifications personally deemed similar to lisenture.
4. Confidence and personal empowerment was the third most recorded reason for professional certification, probably following from an individual's demonstrated performance by completing the certification (Adams, Brauer, Karas, Bresnahan, & Murphy, 2004; Davis & Rubin, 1976; Lipner, Hess & Phillips, 2013; Prowant, Niebuhr, & Biel, 2007; Thomchick & Humphrey, 1996; Williams, Lopez, & Lewis,

2013). Tying with the increased knowledge base, individuals felt more prepared to handle greater problems and challenges, having learned appropriate techniques and methods to apply.

5. Job credentials and career advancement addresses certification required for employment or a distinguishing resume feature; moreover, certification was mentioned from employees as a signal of improvement to upper management (Adams, Brauer, Karas, Bresnahan, & Murphy, 2004; Ewert & Kominski, 2012; Fawcett & Rutner, 2014; Gorbell, 2006; Hall & Mitchell, 2010; Phillips, 2004; Prier, McCue, & Behara, 2010; Prowant, Niebuhr, & Biel, 2007; Thomchick & Humphrey, 1996). While not replacing the requirement for a given level of educational background, certification clearly separates potential hires amongst each other. If desiring to stay with the same company, certification displayed an individual's desire for increased responsibility and personal motivation in the field.
6. Tied with credentials and advancement, a salary increase settled as the second most recorded reason for certification. Under this reason, individuals pursued certification mostly as a means for higher pay, expecting financial support for completing certification (Adams, Brauer, Karas, Bresnahan, & Murphy, 2004; Hall & Mitchell, 2010; Prowant, Niebuhr, & Biel, 2007; Thomchick & Humphrey, 1996). Although coming from the APICS (2015) certification agency, "APICS CSCP designees earn on average 21 percent more than professionals without the designation. And 63 percent of APICS CSCP designees report that the certification had a positive impact on hiring decisions".

7. Similar to licensure, some fields legally require certification for entrance or continued service in the particular workforce. Although not nearly as stringent as licensure, such a requirement presents a barrier to entry for individuals. While this reason did not appear in previous research, one specific example comes from the DoD Financial Management career. To be a comptroller or legally obligate the government to contracts, an individual must pass and maintain the respective certification.
8. Commitment to a profession appears briefly in some papers, but this reason was overshadowed by the others mentioned above. In terms of military service, members agree to serve for a set number of years, with subsequent actions extending the terms of service. While employees at civilian companies usually have legal freedom to leave as desired, most military members continue to serve because of an underlying commitment to duty or the profession of arms.

Corporate Purposes

Besides the reasons for an individual to want professional certification, companies themselves can benefit directly and indirectly from certified employees. The main reasons for corporate support with professional certification came from prestige with the public, ability to outsource education, better educated workforce, state or government endorsement, and standards.

1. As with the personal motive, companies endorse certification, because it garnered prestige with public. Consumers, other companies or future partners viewed certification in a positive manner (Adams, Brauer, Karas, Bresnahan, & Murphy, 2004; Blalock, 2012; Williams, Lopez, & Lewis, 2013). Looking at a personal

example, suppose you want to build a house and hire a contractor. All costs being equal, would you prefer someone supported by an independent certification or just whoever answered your request? In some instances, the lack of certified employees has caused legal disputes and higher costs for companies, especially in the medical and personal training fields.

2. Similar to all products or services, a company can either produce or buy the desired item. In this case, companies without a strong background in specific techniques or management principles can outsource education through certification. Also if only a small number of employees require education, it might be cost prohibitive to perform the actions internally (Lummus, 2006; Phillips, 2004).
3. Companies also saw certification leading to better educated workforces. As individual employees learned new skills and broadened their perspectives, the firms realized results in cost savings and avoidance, more streamlined processes and other improvements (Phillips, 2004; Williams, Lopez, & Lewis, 2013).
4. State or government endorsement of certification incentivized some companies. By partnering with community colleges or other job placement agencies, many firms hire certified employees (Adams, Brauer, Karas, Bresnahan, & Murphy, 2004; Goodman, Meyer, & Imperatore, 2014; Gorbell, 2006; Hall & Mitchell, 2010; Prier, McCue, & Behara, 2010; Remer & Ross, 2014). Also in a recent development of government support for certification, the Department of Labor and Census Bureau has started tracking certifications throughout the workforce, similar to educational levels attained (Ewert And Kominshi, 2014).

5. An external account of standards presented the greated corporate reason for certification. Outside organizations determining and measuring specific standards separate from influence by the reviewed firm created the external control. Any company advertising that it is six-sigma certified relies on the meaning and importance of standards. Just like some firms might require specific certification to conduct business, government contracts might also involve certain certifications for a company to compete for the work.

Air Force and DoD Problems

The wide scope and breadth of logistics officers in the Air Force have stretched the required baseline knowledge for incoming officers. Examining the multitude of skills and comprehensive understanding of tasks involved allows specific areas to go unnoticed in introductory education. SCM represents one specific area rarely addressed in the current education. From a previous study, 60 critical knowledge, skills, and abilities (KSAs) were validated in the mission sets of Deployment, Distribution, Materiel Management, Life Cycle, and Joint Logistics, with training or education in contracting, acquisitions, and process improvement falling short (Roberts, 2013). Following the officer accession process, most logistics officers would not be exposed to all elements that the DoD considers significant. The introductory education courses for logistics and maintenance officers provide only baseline knowledge over the specific officer's undergraduate education.

Several documents and reports also highlight problems for the DoD with SCM. DoD Supply Chain Management remains on the Government Accountability Office's

High Risk List, as of 2015. Specific action items highlighted in the report were inventory management, materiel distribution, and asset visibility, further elaborated as:

> "DoD faces challenges in reducing excess inventory, managing its economic retention stock, and continuing improvements in demand forecasting" (Government Accountability Office, 2015, p186-187)
>
> "without a corrective action plan that measures distribution performance across the entire distribution pipeline, identifies gaps and the root causes of these gaps, develops solutions, and includes reliable metrics to measure performance of the entire distribution pipeline, except for on a case-by-case basis DOD will be limited in its ability to comprehensively monitor and independently validate the effectiveness and sustainability of solutions to demonstrate progress" (Government Accountability Office, 2015, p190)
>
> "it is too early to tell if these combined efforts will result in measurable outcomes and progress in realizing DOD's goals and objectives for improving asset visibility" (Government Accountability Office, 2015, p192).

The report does indicate that the DoD has made corrective strategies and attempts in some areas, but those plans required people to develop and implement. Just because one problem gets fixed today doesn't mean another issue won't come up tomorrow, so the Air Force must prepare future leaders to handle SCM issues.

A technical report from RAND gave several opportunities to improve DoD supply chain integration. The report also pushed for "career development that imbues people with the knowledge and capabilities to act in the best interests of the total supply chain" (Peltz, Robbin, McGovern, 2012, pXV). Both the Government Accountability Office and RAND report speak to problems currently facing the Air Force supply chain. Not only are cost savings and avoidance potential outcomes, but also improved combat effectiveness and military readiness. However, the systems and programs used to monitor the supply chain will not implement any new initiative or come up with better

ideas for the future. An investment in people and their ability to understand the complex movements of the supply chain will best prepare the Air Force for financial success.

Just like corporate America, the DoD followed the push for higher education. While officers were always required to get undergraduate degrees to serve, a higher percentage of enlisted and civilian members have earned associate, undergraduate or graduate degrees. Several decades ago, people earned degrees or certificates just to use or code computers, but almost every individual coming into the Air Force already understands how to operate a computer. Just as educational standards and program requirements have changed, the expectations and demands on individuals have shifted just as much.

The increasing complexity and investment in logistic systems requires highly educated or experienced workers to provide the expected levels of service. To continually improve worker technical capabilities, the DoD and individual services continually look at educational requirements, opportunities, and available programs.

> "A DoD-specific Certificate and Certification program will support the LCDF by providing a program of recognition that defines levels of professionalism over the course of an individual's career. Certificate/certification is a step beyond the assessment process and carries an added degree of significance" (Office of the Secretary of Defense, Logistics & Materiel Readiness, 2008, p19).

Certification has become a significant focus for the DoD. Unfortunately, no consolidated certification program currently exists within the DoD for SCM. There are certificate programs in several other areas that combine online courses into a set education plan.

Motives Against Certification

Any new venture faces possible shortfalls, and certification may not lead to all the expected results. Pertaining to professional certification, the Air Force may not have the appropriate incentives already established.

1. Several articles mentioned no significant change in performance, compensation, or other motivating factors following certification. In this matter, individual certification did not lead to quantifiable improvements for the individual or company (Davis & Rubin, 1976; Ulmer, 2010; Phillips, 2004). For Ulmer, potential benefits from individual certification succumbed to team dynamics, as certified individuals were paired with non-certified members in a team.
2. Compared to other fields, competing certifications segregated the SCM field and confuse individuals. If a certified public accountant (CPA) was mentioned, most business people should understand the meaning. Unfortunately, the abundance of SCM related certifications and other programs leave no single certification as the recognized leader in the discipline. While there are several predominant certifications for SCM, there is no explicit term to describe a certified professional.
3. Professional certification without reimbursement or reward could create a disincentive for employees. Depending on the individual's personal reasons for getting a professional certification, the financial compensation or future employment opportunities become paramount. Arguably, the individual reasons for certification are not mutually exclusive, as several reasons might combine to drive someone toward professional certification. Taken to a higher level, some recent college graduates have stated how they are actually worse off getting a degree because of

student loans, lack of available jobs, and lost time for experience. While the Air Force could feasibly cover the cost for certification, no pay raise or other financial compensations would be granted.

4. Similar to the item above, poor support or recognition from management also makes individuals rethink pursuing professional certification. As many of the personal reasons deal with relations to other people, recognition or endorsement from management becomes essential. For the targeted population, a problem arises from competition with advanced degree classes or other education. If commanders or managers do not endorse certification on par with advanced degrees when considering individual awards and recognition, young officers may not devote the time and effort toward professional certification.

Civilian Certification Programs

Numerous organizations provide some form of certificate or certification. Giving a brief overview, the various certification agencies and programs considered during research are listed in Table 1.

Table 1. Certification Programs

Company/Organization	Program	Website
American Society of Transportation and Logistics merged with APICS	Logistics, Transportation and Distribution Certification (CLTD)	http://www.apics.org/apics-logistics-transportation-and-distribution-certification
Association for Operations Management (APICS)	Certified Supply Chain Professional (CSCP)	http://www.apics.org/careers-education-professional-development/certification/cscp
Association for Operations Management (APICS)	Certified in Production and Inventory Management (CPIM)	http://www.apics.org/careers-education-professional-development/certification/cpim
Council of Supply Chain Management Professionals (CSCMP)	SCPro™	http://cscmpcertification.org/overview/
Council of Supply Chain Management Professionals (CSCMP)	LINCS Education	https://cscmp.org/education/lincs/lincs-education
Institute for Defense & Business	Life Cycle Executive Leadership Program	http://www.idb.org/programs/lcelp
Institute for Supply Management (ISM)	Certified Professional in Supply Management (CPSM)	https://www.instituteforsupplymanagement.org/certification/content.cfm?ItemNumber=29023&navItemNumber=28809
Institute of Supply Chain Management	Supply Chain Certification	http://www.ioscm.com/qualifications/supply-chain/
International Institute For Procurement & Market Research	Certified Supply Chain Specialist	http://iipmr.com/education/cscs.html
International Supply Chain Education Alliance	Certified Supply Chain Analyst	http://www.iscea.net/csca
Logistics & Supply Chain Management Society	Certified Logistics Professional	http://lscms.org/certified-logistics-professional-certification/
Manufacturing Skills Standards Council	Logistics Certification	http://www.msscusa.org/logistics-certification-claclt/
Supply Chain Management Association	Supply Chain Management Professional	http://www.scma.com/en/education-accreditation/scmp-designation-program
The International Society of Logistics (SOLE)	Certified Professional Logistician (CPL)	http://www.sole.org/cpl.asp
The International Society of Logistics (SOLE)	Certified Master Logistician	http://www.sole.org/cml.asp
The International Society of Logistics (SOLE)	Demonstrated Logistician	http://www.sole.org/dlp.asp

Air Force Program

Instead of addressing an entire program for the DoD, this project examines a specific program the Air Force can implement for its logistics officers. With the growing focus on SCM and the lack of available programs, a proposed development plan was created to meet Defense Acquisition Workforce Improvement Act guidelines, given below in Table 2. The overall program looked at specific education necessary for a sound SCM program, leading to three different levels of certification. The proposed structure provides great guidance for an Air Force internally implemented certification program; however, commercially available testing organizations were a primary focus. An outside organization would provide an objective testing body that maintains set standards.

Table 2. SCM Characteristic to Course Cross Reference Matrix (Griffin and Trinrud, 2007, p34)

Johnson and Pyke Characteristic	**Proposed Course**
Location	SCM 101, 104, 201
Transportation and logistics	SCM 104, 201
Inventory and forecasting	SCM 202
Marketing and channel restructuring	SCM 201
Sourcing and supplier management	SCM 204
Information and electronic mediated environments	SCM 203
Product design and new product introduction	SCM 304
Service and after sales support	SCM 202
Reverse logistics and green issues	SCM 301, 303
Outsourcing and strategic alliances	SCM 301
Metrics and incentives	SCM 304
Global issues	SCM 302

Determining Criteria

Overall distinction should be made between logistics and SCM. In the broad sense, logistics refers more to the physical actions when moving or controlling goods, parts, or property. SCM looks at the product, cash, and information flows. The distinction becomes important when determining decision criteria, as many Air Force officers already receive introductory logistics education. As one selection criterion, an emphasis on SCM must be present. Specific elements of SCM are provided in Figure 7.

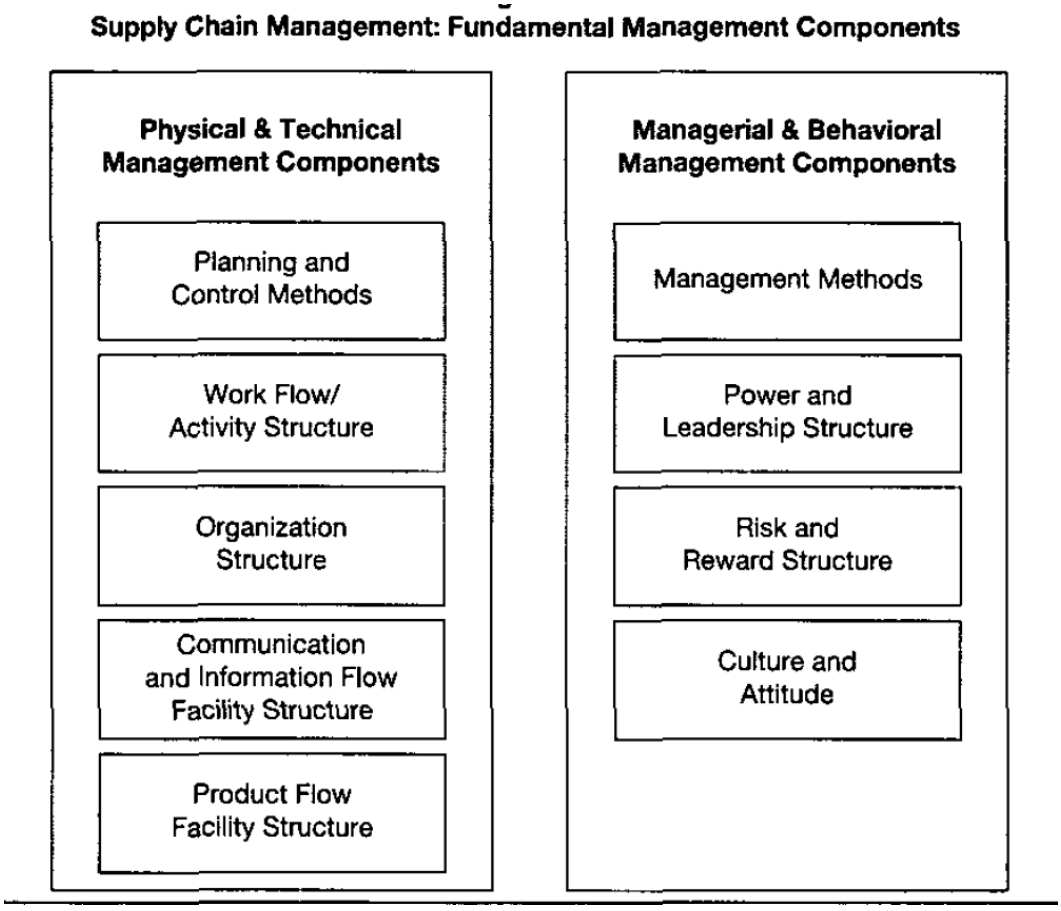

Figure 7. Supply Chain Management: Fundamental Management Components (Lambert, Cooper, and Pagh, 1998, p12)

Summary

The literature review focused on several aspects including SCM definitions, elements of certification, reasons for certification, and criteria supporting the decision making process. With many different definitions for SCM, a specific definition for the scope of this thesis was given. Elements of certification separated certification from certificate programs. Numerous reasons for certification exist, including both personal and corporate themes. Finally, proposed criteria were reviewed to implement a decision analysis.

III. Methodology

Chapter Overview

Finding and recommending the most appropriate certification method remains the primary determination of this research. As such, the most appropriate way to analyze and compare alternative options falls in the realm of a business case analysis or decision matrix. Moreover, limiting the number of acceptable certification programs was addressed. Questions to defense industry partners uncovered good business practices from other large corporations.

Certification Programs

The initial list of certifications came from a Google search of "supply chain management certification". Results displayed thousands of hits, including certificate programs, articles on SCM certification, and university offerings. Educational programs at colleges were not added to the list, falling outside the scope of research. Most education offerings from colleges also exhibited a certificate approach, not certification. The Air Force already has established relationships with certain schools to provide senior executive SCM courses. The research saw no benefit comparing one school's certificate program against another when professional certification was the main method being studied. Other programs came from talking with educators and representatives at conferences. These programs included options supported by DoD related organizations.

Cutting down the list of available programs addressed the elements of certification given in chapter 2. Eliminating programs from the remaining list focused on

those without an educational or work experience requirement. The next cut came from removing programs without a cumulative or comprehensive exam. Finally, the last cut of programs looked at certificates, mostly programs that covered course completion.

Questions for Defense Industry Partners

Civilian companies use existing certification programs for educational means. With the Air Force looking at certification, asking questions from industry partners already familiar with professional certification seemed appropriate. The Air Force wants to educate supply chain managers to better understand and interact with industry. Implementing similar practices to companies supporting the DoD could prove most effective. The researcher asked the questions below to defense industry partners through infernal interviews.

1. What functions/activities are considered in supply chain management?
2. What is the normal process to build or educate supply chain managers?
3. Is there a formalized or standard process for training supply chain managers? If so, is that stated in any form of document or education plan?
4. When hiring supply chain managers, does educational program background or experience have significant impact?
5. Does your company encourage or pay for professional certification in supply chain management? If so, any specific program?
6. Are there other preferred training or education programs considered instead of professional certification?

The researcher emailed the above questions to respondents. Potential respondents came from individuals in the SCM area of their business. A follow-up call ensured accurate interpretation of returned answers. Respondents were identified at conference

attendances or contacted through the company's human relations department. Questions also inquired about other education or training measures implemented besides certification. The most valuable responses came from several individuals: Mr. Berger with Boeing, Mr. Boatner and Mr. Morganthaler from GE Aviation, and Mr. Anderson at Lockheed Martin Aero.

Decision Making

As with any decision, a primary consideration involves weighing positive benefits against implementation costs or other negatives. Value-Focused Thinking seeks to align proposed alternatives with the expected values measuring the decision in the first place. As a definition, "Values…are principle for evaluating the desirability of any possible alternative or consequences" (Keeney, 1994, p33). In the Air Force's case, values may include the specific areas for improvement over current operations, such as having an officer certified in SCM serving in specific positions. Certifications should not be valued just for the sake of certification.

> "Value-focused thinking will help you in three major ways: to recognize and identify decision opportunities, to create better alternatives for your decision problems, and to develop an enduring set of guiding principles for your organization" (Keeney, 1994, p33).

Applying the appropriate rigor when determining alternatives, Value-Focused Thinking should lead to the best outcomes.

Very few articles approached the problem of choosing one certification over another. To help distinguish between SCM professional certifications, the researcher developed and applied criteria in a decision analysis. Cost, Subject Matter, Completion Time, Learning Support, and Reputation provided a straightforward and simple approach

as criteria. The criteria came from the reasons for certification, although all may not have a direct link.

Each criterion looked at specific points available from certification program websites. Cost considered the non-member testing cost and potential retesting fee. To avoid the inclusion of member fees, the member testing rate was not used. Subject Matter looked at overall the inclusion of topics related to SCM definition. As the DoD definition was overly broad, specific areas of SCM came from the Workforce Competency Technical Categories of the DoD Human Capital Strategy. No better list of SCM activities or focus areas could be found. Completion Time took the average preparation time for an individual. Learning Support reflected material accessed online, available teachers, or education materials available. Last, reputation revealed the number of individuals holding certification, total members, or relevance from commercial partners.

Summary

Certification programs became the highlight of research. A list of the most notable certification programs came from a Google search, cut down for the reasons mentioned above. The researcher asked industry partners questions pertaining to professional certification.

IV. Analysis and Results

Chapter Overview

This chapter covers responses from industry, certifications already established in the Air Force and DoD, and the most advantageous certification programs.

Answers From Industry Partners

Industry responses followed the DoD definition for SCM in a broad sense. The DoD definition used was "a cross-functional approach to procuring, production, and delivering products and services to customers". Defense partners used different terms, such as purchasing and logistics, but the main ideas remained similar. However, industry saw procurement and supplier relations more important, compared to Air Force education on those subjects for logistics officers. Industry answers came from the individuals previously mentioned (Mr. Berger, Mr. Boatner, Mr. Morganthaler, and Mr. Anderson) though personal communications.

With Questions 2 and 3, defense partners acknowledged a more formalized and deliberate process for developing supply chain managers. New hires might spend between 2-4 weeks shadowing a mentor and receiving classroom instruction. Workload and complexity gradually rise as the employee learns from new experiences. Compared to the Air Force, new entrants into the SCM area may have to learn on the job without such stringent mentorship. The Air Force does provide excellent education in the areas of maintenance and logistics. Such education and training can be found in the Career Field Education and Training Plans. However, industry followed similar processes and

education plans specifically for SCM. Deliberate and documented education and development plans were mentioned. Educations plans combined a mixture of annual reviews, SCM education, specific job training, and mentorship.

The question of educational program background relates directly to those being hired in industry. For SCM jobs, companies look specifically for individuals with that educational background or closely related field like logistics. Education also becomes important, with experience in procurement or SCM from another field desired. At the baseline level, most logistics officers do not exhibit the same characteristics as new hires in industry.

Questions 5 and 6 looked at the importance of certification and other education methods. All respondents mutually agreed about certification being encouraged but not necessary. Approximate numbers of individuals with certifications in SCM positions varied but remained fairly low around 5%-10%. Companies reported either paying for certification prep classes and exams or reimbursement. One respondent specifically mentioned APICS and ISM as reimbursable certifications for employees. The other respondents did not mention any particular program as preferable. All industry partners cited internal programs as the most preferred training or education method. Internally developed SCM courses, both online and instructor led, proved most helpful. Other outside education, such as the SCOR model, would be held occasionally when needed.

Other DoD Certification Programs

Several other career fields either require or promote professional certification. The financial management community has both DoD internal and civilian certification

programs. Program management endorses the Program Management Professional certification. The civil engineering community encourages certification for development purposes and formal recognition. The Defense Acquisition University also runs several programs through online courses; however, these programs do not usually have a cumulative exam. Professional certification in the SCM realm would not be an entirely new concept in DoD or the Air Force.

Eliminated Programs

Applying the elements of certification shortened the list of applicable certification programs. The largest cut came from programs not requiring professional experience or educational background. Most university SCM course offerings and other certificate programs omitted the above requirements. A second cut eliminated options without a cumulative or extensive exam or continuing education requirements. Only one certification was considered from each organization, so Table 3 also omitted secondary programs. Four remaining programs were: APICS's CSCP, SOLE's CPL, ISM's CPSM, and CSCMP's SCPro. The Air Force did not have any internal program meeting all aspects of the certification definition.

Table 3. Eliminated Programs

Company/Organization	Program	Reason Eliminated
All university or college certificate programs		Outside focus area of research pertaining to professional certification
Institute for Defense & Business	Life Cycle Executive Leadership Program	Missing element of certification either: professional experience or education background, cumulative exam, or continuing education requirement
Institute of Supply Chain Management	Supply Chain Certification	
International Institute For Procurement & Market Research	Certified Supply Chain Specialist	
International Supply Chain Education Alliance	Certified Supply Chain Analyst	
Logistics & Supply Chain Management Society	Certified Logistics Professional	
Manufacturing Skills Standards Council	Logistics Certification	
Supply Chain Management Association	Supply Chain Management Professional	
American Society of Transportation and Logistics merged with APICS	Logistics, Transportation and Distribution Certification (CLTD)	Second or other program offered by the same main organization
Association for Operations Management (APICS)	Certified in Production and Inventory Management (CPIM)	
Council of Supply Chain Management Professionals (CSCMP)	LINCS Education	
The International Society of Logistics (SOLE)	Certified Master Logistician	
The International Society of Logistics (SOLE)	Demonstrated Logistician	

Evaluating Programs With Criteria

Programs competed against each other in the areas of Cost, Subject Matter, Completion Time, Learning Support, and Reputation. The researcher deemed these

criteria most applicable to the Air Force and implementation. Most criterion presented set values, but Subject Matter needed further analysis and comparison.

Important areas in SCM for Subject Matter came from the Workforce Category Technical Competencies. As given in Table 4, the topics identify specific competencies a professional certification should address. The 15 focus areas included Forecasting and Demand Planning, Supply Planning, Sourcing, Inventory Management, Deployment Planning, Physical Distribution/Transportation Operations, Maintenance Operations, Production and Support, Logistics Design Influence, Integrated Logistics Support Planning, Product Support and Sustainment, Configuration Management, Reliability and Maintainability Analysis, Technical/Product Data Management, and Supportability Analysis. The DoD Human Capital Strategy contained the best list of SCM activities when reviewing Air Force documents.

Table 4. Subject Matter Comparison

	APICS	CSCMP	SOLE	ISM
Supply Management				
Forecast and Demand Planning				
Supply Planning	X	X	X	X
Sourcing	X	X	X	X
Inventory Management	X	X	-	X
Deployment/Distribution/Transportation				
Deployment Planning	-	-	-	-
Physical Distribution/ Transportation Operations	X	X	X	X
Maintenance Support				
Maintenance Operations	-	-	-	-
Production and Support	X	X	X	X
Life Cycle Logistics				
Logistics Design Influence	-	-	X	-
Integrated Logistics Support Planning	X	X	X	X
Product Support and Sustainment	X	X	-	X
Configuration Management	-	X	X	-
Reliability and Maintainability Analysis	X	X	X	X
Technical/Product Data Management	-	-	-	-
Supportability Analysis	X	X	X	X

Table 4 identifies the topic areas covered by each certification program. An X in the intersecting box shows the certification program tested on the given area. The researcher had to adjust and interpret material when names did not match. For instance, one program might test on procurement instead of sourcing, but the terms roughly reflect the same ideas. No program clearly mentioned Integrated Logistics Support Planning, Reliability and Maintainability Analysis, and Supportability Analysis. The researcher attributed these topics to themes like product and service development, systems management, or product evaluation. Deployment Planning, Maintenance Operations, and Technical/Product Data Management failed to appear in any certification program.

Subject Matter became a problematic area for comparison. Ultimately, Subject Matter should be the most important criteria if a weighted scale was employed. The topics identified in Subject Matter concern the Air Force's ideas of SCM. To have knowledgeable people in SCM, the respective individuals should have demonstrated competence in the given topics. The researcher tried to fairly asses each program on content, but Subject Matter comparison remained highly biased to topic area descriptions. The clear deficiencies across all certification programs give rise for concern. Programs also varied in material not mentioned as technical competencies, specifically with supplier relations management, enterprise resource planning, and cash flows in SCM. Ultimately, differences between the certification programs in the criterion of Subject Matter remained ambiguous and not clearly significant.

Figure 6 consolidates the pertinent details of each certification program for easy comparison. With Subject Matter comparable between programs, learning support and reputation became key areas of contention. Practice exams, study materials, and access

to instructors should greatly increase chances for members to pass an exam. Reputation applies to the image officers garner for the Air Force when interacting with industry. Acceptance from industry based on certification standards and common business lexicon also impact reputation.

	APICS	CSCMP	SOLE	ISM
Cost	$795 non-member, $385 retest	$975 non-member, $395 retest	$375 non-member, $50 retest	$1800-$2400 non-member
Subject Matter (# of topics)	9	10	9	9
Completion Time	~ 100 hrs	~ 48 hrs	Not stated	avg 6 – 12 months
Learning Support	Practice exam, study guide for purchase; resident course offerings	Practice exam, study guide for purchase; online study groups	Practice exam, reading list; recommend partnering with local chapter	Practice exam, study guide for purchase
Reputation	19,000 members in 82 countries	8,500 members in 67 countries	Presence in 50 countries; recognized on Army records	60,000 members in 30 countries

Figure 8. Comparison Overview

If choosing only one program, APICS presents the best option. CSCMP comes as a close second, mostly on the basis of cost. Although SOLE has the cheapest program, study material available to help individuals pass the test and unknown study time present problems. ISM has an advantage with reputation, but the certification focuses more on purchasing and sourcing and has a higher cost.

Summary

Only four programs remained after applying the definition of certification. Responses from industry partners showed some stark contrasts to Air Force methods. APICS settled as the best option if considering only one program. However, the determination remains highly subjective based on subject matter covered by the certification.

V. Conclusions and Recommendations

Chapter Overview

Professional certification presents several beneficial outcomes for the Air Force. Appropriate application of certification could enable significant cost savings while protecting the defense industrial base. However, specific unknowns and a developing SCM function in the Air Force requires limited action. A trial period employing a mix of certification programs seems most successful.

Conclusions of Research

Professional certification in SCM could benefit the Air Force. Personal reasons for certification covered an increased knowledge base or competence, prestige with others in similar or different fields, feeling more professional, confidence or personal empowerment, a job credential, increased salary, legal requirements, and commitment to a profession. Corporate reasons for certification looked at prestige with the public, ability to outsource education, better educated workforce, state or government endorsement, and standards. Industry partners also valued certification in conjunction with internal SCM education programs.

The researcher identified and compared numerous certification options. Most programs did not meet the elements of certification, based on professional experience, a comprehensive exam, or continuing education. Four remaining programs considered were APICS's CSCP, SOLE's CPL, ISM's CPSM, and CSCMP's SCPro. Criteria to compare programs against each other included Cost, Subject Matter, Completion Time,

Learning Support, and Reputation. Subject Matter specifically came from the Workforce Category Technical Competencies previously given.

Recommendations for Action

APICS's CSCP is the most appropriate if choosing only one certification program. APICS covers comparable subject matter to the other certification programs. Although not the cheapest option, APICS excelled in best value regarding the learning materials and support available. As a whole, APICS certification should provide more rigorous education in SCM at a lower cost per person than the current university certificate programs.

Using only one certification program does pose problems. A high degree of uncertainty remains with professional certification implementation. While certification does confer benefits to the individual and organization, currently the specific skills lacking in Air Force SCM are unclear. If certification programs address those missing skills, then a full and formalized certification initiative would be the best option. As different positions in SCM for the Air Force might require slightly different skills, a trial period utilizing multiple civilian certification programs offers the best path.

All logistics officers do not need professional certification or the same certification. APICS's CSCP might be more applicable for one duty than SOLE's CPL. As industry partners responded, no one certification was employed above all others. Internal SCM education programs also support the development of Air Force education after certification. In the current state, the Air Force could benefit most from using civilian certification programs readily available. Over time, additional short courses or

revamping the certification effort could occur. By implementing a trial period with multiple certification programs, the Air Force could test the most applicable certifications and identify topic areas for improvement.

Differences in subject matter became the last point of contention. Definitions and meanings could exhibit differences between certification organizations and Air Force terminology. Certification exams probably do not test all topics equally. Varying number of questions and difficulty would emphasize certain topics and areas over others. The researcher could not determine how well any one exam measures any one topic. Finally, the 15 topics areas from the DoD Human Capital Strategy may not fully encompass all important areas of SCM for the Air Force. Current unknown topic areas might exist that should be taught in SCM for Air Force officers.

A trial period presents the most cost effective measure given multiple unknowns. Certification does not need to be implemented across the logistics career field. Such measures would only incur additional costs, potentially without any added benefit. While SCM principles are important, really only those directly working in SCM need professional certification. Certification can help improve SCM in the Air Force, but there is no guarantee certification will meet all perceived gaps in subject matter. A trial program limits the full implementation costs and allows exploration into unknown knowledge deficiencies.

The Air Force operates differently from industry, both in operations and procurement. Legal constrains and normal business practices could also interfere with effective SCM in the Air Force, especially in the realm of supplier relations, demand forecasting, and procurement. Certification would educate individuals on better business

practices, but those practices may conflict with current business operations. A trial program with certified individuals might help highlight and expose the internal process conflicts. Full implementation with a certification program would face the same problems, but managing a larger pool of applicants and education efforts might trump resolving the underlying issues.

The trial program should incorporate multiple certifications. All four main certifications (APICS's CSCP, SOLE's CPL, ISM's CPSM, and CSCMP's SCPro) must be considered. A mix of people in various positions throughout the supply chain should earn one of the four certifications, approximately 30 people for each certification to reach a large sample size. People in similar positions getting different certifications could compare the applicability of a certain certification to specific jobs. Testing the trial period over one year grants individuals time to get certified and also apply principles learned in job performance. Polling or surveying individuals in the trial program should yield the best results on certifications necessary or useful in different jobs.

Recommendations for Future Research

A survey of certification in SCM held across industries would provide valuable insight in current standing. While organizations can report a total number of members, knowing the most applicable certification for specific industries or positions may not be reported. One individual might also hold two or more certifications, possibly one outside the SCM field for a current position. Identifying the leading certification organizations could help encourage consolidation to one recognized SCM certification.

Military officers in DoD already hold certifications in SCM. Taking a broad scope, individual services or the DoD as a whole could survey military members about currently held certifications in SCM. As SCM and logistics apply to specific career field, the targeted audience could be segregated from all officers in service. The Air Force would gain visibility into the number and variety of current SCM certifications maintained by military members.

Summary

The researcher considered the impact of professional certification in Air Force SCM. Certification provides multiple benefits and remains a viable option for SCM education. However, certification does not need to be levied on all logistics officers. Certification should come in conjunction with a formalized and deliberate SCM development plan.

Appendix A

Email response from Mr. Anderson, Lockheed Martin Aero, 21 Dec 2015:

Capt. Clawson,
Below is a response to your questions:

1) What functions/activities are considered in supply chain management?
- Supply Chain Management includes sourcing, procurement, negotiations, price/cost analysis, schedule/delivery support analysis, transportation and logistics, administration tasks, compliance to FAR/DFAR and terms and conditions requirements.

2) Is there a formalized or standard process for training supply chain managers? If so, is that stated in any form of document or training plan?
- Lockheed Martin has numerous Aerocodes and training documents in which all are proprietary to Lockheed Martin.

3) What is the normal process to build or train supply chain managers?
- Yes we have a standard process that starts with two weeks of classroom training followed by assigning a mentor for continued on the job support. Normally the new hire will shadow the mentor and provide support for the first several weeks before they are provided a workload. The complexity of the workload is increased overtime as they continue to grasp the concepts.

4) When hiring supply chain managers, do educational program backgrounds or experience have significant impact?
- Typically we look for individuals with a Supply Chain Management or Logistic. From an experience perspective, we look for an individual with government procurement experience or procurement experience in a related industry.

5) Does your company encourage or pay for professional certification in supply chain management? If so, any specific program?
- The company encourages continued education and pays for related coursework leading to a degree. Certifications are encouraged but not necessary.

6) Are there other preferred training or education programs considered instead of professional certification?
- Our company has developed internal training courses at our CLE training center and will bring in other training companies from time to time to hold various training that pertains to supply chain. Overall the vast majority of training is internal.

Please let me know if you have any additional questions.

Regards,
Shawn Anderson, Phone - (817) 762-2036, shawn.p.anderson@lmco.com

Email response from Steve Berger, Boeing, 22 Dec 2015:

Capt Clawson – see below for the responses that our functional team put together for your questions.

1) What functions/activities are considered in supply chain management? Boeing has adopted the Supply Chain Operations Reference (SCOR) model to define the functions/activities included in supply chain management. Within the framework of Plan, Source, Make, Deliver, and Return are included activities related to Supply Chain Architecture Design, Manufacturing Resource Planning and Scheduling, Demand Forecasting, Inventory Optimization, Order Management, Source Selection, Procurement, Supplier Oversight, Inventory Management, Logistics, and Repairs Management.

2) Is there a formalized or standard process for training supply chain managers? If so, is that stated in any form of document or training plan? Assigned managers are responsible for defining the supply chain employee's training plan on an annual basis. This plan is documented on the employee's Training and Development website. The training plan includes a combination of Boeing mandatory training and training tailored to the employees specific job role.

3) What is the normal process to build or train supply chain managers? The employee in partnership with their assigned manager defines a personal development plan. The personal development plan will follow the 70/20/10 developmental model with development opportunities weighted 70% learning from new experiences (assignments), 20% learning from others (coaching/mentoring) and 10% learning through courses & materials.

4) When hiring supply chain managers, do educational program backgrounds or experience have significant impact? Specific education and experience is required based on the job classification and grade level. Job applicants are selected through a structured interview process, which includes a question related to education and work related experience.

5) Does your company encourage or pay for professional certification in supply chain management? If so, any specific program? Boeing offers tuition reimbursement for certification prep courses offered by accredited institutions. Boeing reimburses exam fees for supply chain certification sponsored by the American Production and Inventory Control Society (APICS) and the Institute of Supply Management (ISM).

6) Are there other preferred training or education programs considered instead of professional certification? The Supply Chain Management Function is responsible for development and maintenance of internal supply chain management training courseware. This courseware includes both instructor led and on-line training. Supply Chain employees are encouraged to pursue continued education in supply chain related disciplines. Supply Chain employees are reimbursed for external continued education

received from Boeing approved schools, and for Supply Chain certification exam fees via the company's Learning Together Program.

Thanks,
Steve
steven.a.berger@boeing.com

Bibliography

Adams, P. S., Brauer, R. L., Karas, B., Bresnahan, T. F., & Murphy, H. (2004). Professional Certification. *Professional Safety*, 49(12), 26-31.

APICS. (2015). Retreived from http://www.apics.org/careers-education-professional-development/certification/cscp/eligibility-application.

Bechtel, C., & Jayaram, J. (1997). Supply Chain Management: A Strategic Perspective. *The International Journal of Logistics Management*, 8(1), 15-34.

Blalock, C. M. (2012). Professional Designations: Evaluating Expert Witness Credentials. *American Journal of Family Law*, 26(1), 31-37.

Davis, H., & Rubin, H. W. (1976). Perceived Benefits of Professional Certification. *Journal of Risk and Insurance,* 43(1), 152-155.

Defense Acquistion University. (2016). *Supply Chain Management.* Acquisition Community Connection. Retrieved from https://acc.dau.mil/CommunityBrowser.aspx?id=22412.

Dion, R. E., Jr. (2013). Requirements for Becoming a Project Management Professional. *Engineer*, 43(2), 31-33.

Ellram, L., & Cooper, M. (2014). Supply Chain Management: It's All About the Journey, Not the Destination. *Journal of Supply Chain Management*, 50, 8-20.

Ewert, S., & Kominski, R. (2014). Measuring Alternative Educational Credentials: 2012. *Current Population Reports Series* P70-138. Washington, DC: US Census Bureau.

Fawcett, S. E., & Rutner, S. M. (2014). A Longitudinal View of Supply Chain Education. *International Journal of Logistics Management*, 25(1), 180-201.

Government Accountability Office. (2015). *High-Risk Series: An Update* [PDF document]. Report to Congressional Committees. Retrieved from http://www.gao.gov/products/GAO-15-290.

Gibson, B., Mentzer, J., & Cook, R. (2005). Supply Chain Management: The Pursuit of A Consensus Definition. *Journal of Business Logistics*, 26(2), 17-25.

Goodman, T. G., Meyer, M., & Imperatore, C. (2014). Incorporating Industry-Recognized Certification. *Techniques*, 89(6), 14-19.

Gorbell, G. L. (2006, Reprint from 1970). The Need for Certiifcation of the Safety Professional. *Professional Safety*, 51(3), 60-64.

Griffin, T. R., & Trinrud, S. A. (2007). *Developing a Supply Chain Management Certification for the Department of Defense*. NAVAL POSTGRADUATE SCHOOL MONTEREY CA.

Hall, D., & Mitchell, K. (2010). Professional Excellence: Becoming a National Board Certified Teacher. *Knowledge Quest*, 38(5), 12-17.

Joint Publication 1-02. (2010). *Department of Defense Dictionary of Military and Associated Terms* [PDF document]. Retrieved from http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf.

Keeney, R. L. (1994). Creativity in Decision Making With Value-Focused Thinking. *Sloan Management Review*, 35(4), 33.

Lambert, D., Cooper, M., & Pagh, J. (1998). Supply Chain Management: Implementation Issues and Research Opportunities. *The International Journal of Logistics Management*, 9(2), 1-20.

Lipner, R. S., Hess, B. J., & Phillips, R. L. (2013). Specialty Board Certification in the United States: Issues and Evidence. *Journal of Continuing Education in the Health Professions*, 33(S1), S20-S35.

Lummus, R. R. (2006). The Role of APICS in Professionalizing Operations Management. *Journal of Operations Management*, 25(2), 336-345.

Mentzer, J. T., DeWitt, W., Keebler, J. S., Min, S., Nix, N. W., Smith, C. D., & Zacharia, Z. G. (2001). Defining Supply Chain Management. *Journal of Business Logistics*, 22(2), 1-25.

National Center for Education Statistics. (2016). Working Definitions of Non-Degree Credentials. *Institute of Education Sciences*, U.S. Department of Education. Retrieved from http://nces.ed.gov/surveys/gemena/definitions.asp.

Office of the Secretary of Defense, Logistics & Materiel Readiness, (2008). *DoD Logistics Human Capital Strategy* [PDF document]. Retrieved from http://www.acq.osd.mil/log/sci/log_human_capital/DoD_Logistics_Human_Capital_Strategy.pdf.

Peltz, E., Robbins, M., & McGovern, G. (2012). Integrating the Department of Defense Supply Chain. RAND NATIONAL DEFENSE RESEARCH INST SANTA MONICA CA. Retrieved from http://www.rand.org/content/dam/rand/pubs/technical_reports/2012/RAND_TR1274.pdf.

Phillips, J. T. (2004). Professional Certification: Does It Matter?. *Information Management Journal*, 38(6), 64-67.

Prier, E., McCue, C., & Behara, R. (2010). The Value of Certification in Public Procurement: The Birth of a Profession? *Journal of Public Procurement*, 10(4), 512-540.

Prowant, B. F., Niebuhr, B., & Biel, M. (2007). Perceived Value of Nursing Certification - Summary of a National Survey. *Nephrology Nursing Journal*, 34(4), 399-402.

Remer, D. S., & Ross, E. M. (2014). Review of Project and Engineering Management Certifications Offered by Professional Organizations. *Engineering Management Journal*, 26(4), 3-12.

Roberts, M. D. (2013). An Empirical Investigation of USAF Logistics Readiness Officer Mission Sets (No. AFIT-ENS-13-M-19). AIR FORCE INSTITUTE OF TECHNOLOGY WRIGHT-PATTERSON AFB OH GRADUATE SCHOOL OF ENGINEERING AND MANAGEMENT.

SAF/FMB. (2014). *Fiscal Year 2015 Budget Overview* [PDF document]. United States Air Force. Retrieved from http://www.saffm.hq.af.mil/shared/media/document/AFD-140304-039.pdf.

Shaffer, F., Crawford, J., & Moss, D. (2012). What Is BCIA Really?. *Biofeedback*, 40(4), 133-136.

Smallfield, J. L. (2013). Certified Facility Manager Certification. *Engineer*, 43(2), 31-33.

Stock, J., & Boyer, S. (2009). Developing a Consensus Definition of Supply Chain Management. *International Journal of Physical Distribution & Logistics Management*, 39(8), 690-711.

Thomchick, E., & Humphrey, T. (1996). The Perceived Value of AST&L Certification. *Transportation Journal*, 36(2), 5-12.

Ulmer, J. 2010. Professional Certification: A Study of Significance. *Journal of Industrial Technology*, 36(2), 2-8.

United States Air Force, 2015. *Logistics Readiness Officer*. Retrieved from https://www.airforce.com/careers/detail/logistics-readiness-officer.

United States Air Force, 2016. *The Air Force Tuition Assistance (TA) Programs.* Ongoing Education. Retrieved from https://www.airforce.com/education/ongoing-education.

Williams, H. F., Lopez, G., & Lewis, K. (2013). Certification - Good for Business. *Nephrology Nursing Journal*, 40(3), 247-254.

Vita

Captain Christopher L. Clawson entered undergraduate studies at the United States Air Force Academy in 2006. He graduated with a Bachelor of Science degree in Economics in May 2010. He was commissioned and recognized as a Distinguished Graduate.

His first assignment was to the 56th Logistics Readiness Squadron, Luke AFB, Arizona. at He served as in various positions as a logistics officers, including vehicle maintenance and materiel management. In July 2013, he was assigned to the Intelligence, Surveillance and Reconnaissance Directorate, Wright-Patterson AFB, Ohio. He worked in the Combat Rescue Helicopter and AC-130J program offices of the Special Operations Forces Division. In August 2014, he entered the Graduate School of Operational Sciences and Logistics, Air Force Institute of Technology. Upon graduation, he will be assigned to the Global Strike Command staff.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 074-0188

PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From – To)*
24-03-2016	Master's Thesis	Aug 2014 - Mar 2016

4. TITLE AND SUBTITLE
Consolidating Supply Chain Management Education Through Professional Certification

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
Clawson, Christopher L., Captain, USAF

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(S)
Air Force Institute of Technology
Graduate School of Engineering and Management (AFIT/EN)
2950 Hobson Way, Building 640
WPAFB OH 45433-8865

8. PERFORMING ORGANIZATION REPORT NUMBER
AFIT-ENS-MS-16-M-096

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Intentionally Left Blank

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
DISTRIBUTION STATEMENT A: APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED.

13. SUPPLEMENTARY NOTES **This work is declared a work of the U.S. Government and is not subject to copyright protection in the United States.**

14. ABSTRACT
The Air Force and Department of Defense can benefit from professional certification in supply chain management. Research addressed the benefits and impact certification can have on individuals and an organization. Without a defined and concise education plan for supply chain management, certification remains a viable option. Interviews with defense industry partners highlighted key aspects of successful SCM development and education programs.

15. SUBJECT TERMS
Professional certification

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			Dr. Kenneth Schultz, Ph.D
U	U	U	UU	69	19b. TELEPHONE NUMBER *(Include area code)* (937) 255-6565 (Kenneth.schultz@afit.edu)