VERSION 2.0

EXAM CONTENT MANUAL

CLTD

CERTIFIED IN LOGISTICS, TRANSPORTATION AND DISTRIBUTION

APICS

ASCM ASSOCIATION FOR SUPPLY CHAIN MANAGEMENT

APICS
Certified in Logistics, Transportation and Distribution
Exam Content Manual

Version 2.0

Visit apics.org/ecmerrata for APICS CLTD Exam Content Manual errata.
Internet links cited in the bibliographic references can be found in a more usable format on the APICS website at apics.org/CLTD.

The references in this manual have been selected solely on the basis of their educational value to the APICS CLTD certification program and on the content of the material. APICS does not endorse any services or other materials that may be offered or recommended by the authors or publishers of books and publications listed in this manual.

8430 West Bryn Mawr Avenue, Suite 1000
Chicago, IL 60631-3439 USA
Phone: 1-800-444-2742 or +1-773-867-1777
Fax: +1-773-639-3000

Stock #09160-V20E

The Association for Supply Chain Management (ASCM) is the global leader in end-to-end supply chain organizational transformation, innovation and leadership. As the largest non-profit association for supply chain, we are an unbiased partner connecting people around the world to the newest insights and solutions on all aspects of supply chain. ASCM transforms enterprises and empowers people with industry-recognized, global standards - like APICS and SCOR - to optimize their supply chains, secure their competitive advantage and positively impact the world.

Table of Contents

Letter to Candidates

Dear Candidate:

Congratulations! On behalf of ASCM and the members of the Certified in Logistics, Transportation and Distribution (CLTD) Subcommittee, I would like to thank you for your expressed interest in the APICS certification program in the field of logistics, transportation and distribution.

The CLTD certification is designed to provide a body of knowledge, technology know-how, and standards for those in the logistics, transportation and distribution industries. The APICS CLTD sets the global standard for logistics best practices and assists employers in developing the personnel needed to meet today's ever-increasing customer demand for logistics service. As one of the fastest growing industries in the world, transportation and logistics remains the second largest employment sector in the United States, employing over six million people, and projected to generate almost 130,000 new jobs through 2024. With a real output growth projected to grow faster than the US economy, the Bureau of Labor Statistics (BLS) projects that total employment in this sector will exceed 160 million by 2024.

The APICS CLTD certification aims to lessen the impact of the logistics industry's skill gaps. The program takes an end-to-end supply chain view of logistics operations, extending from inbound materials management, outbound distribution and reverse logistics to encompass all the integrative process steps that define supply chain logistics. The APICS CLTD certification program provides you with the knowledge to effectively manage the integration of these activities to maximize your company's value chain. By earning the APICS CLTD designation, you will have demonstrated the mastery of logistics best practices.

This APICS CLTD Exam Content Manual (ECM) provides you with an overview of the program, an outline of the body of knowledge, key terminology, and recommended references. The content outline is divided into the following nine diagnostic areas with the relative emphasis of each area indicated by the percentage:

- Logistics Overview and Strategy (8%)
- Capacity Planning and Demand Management (9%)
- Order Management (10%)
- Inventory Management (11%)
- Warehouse Management (13%)
- Transportation Management (17%)
- Global Logistics (15%)
- Logistics Network Design (10%)
- Sustainability and Reverse Logistics (7%)

A sample of ten questions is provided at the end of this manual to illustrate the type of questions you will encounter on the exam. We recommend the APICS CLTD ECM as one of your references as you prepare for the CLTD exam.

We wish you every success in the pursuit of your CLTD designation.

Sincerely,

Yemisi A. Bolumole, Ph.D., CLTD-F, CTL
CLTD Subcommittee Chair

Introduction

This Exam Content Manual provides guidance for individuals preparing for the CLTD certification examination. The objective of this manual is to outline the APICS CLTD exam body of knowledge.

The CLTD body of knowledge section of this manual begins with a statement about the scope of the subject matter, followed by a descriptive outline of the content. Key terminology and a bibliography of suggested references are also provided. The section concludes with sample questions similar to those that appear on the examination, along with correct answers for the sample questions, and brief explanations as to why they are correct.

The recommended procedure for mastering the subject matter is to:

- review the content outline, which defines the scope of the material.
- study each topic area using the suggested references.

At the end of each major section is a list of the references that apply to the topics in that section. The first number indicates the sequence number for the reference in the bibliography section and the numbers in parentheses indicate the relevant chapters within that reference.

Candidates should understand the definitions of key terminology and the application of the outlined tools, processes and techniques.

Sufficient references are given for each topic area that provide different approaches to the material covered. Reading periodicals, such as SCM Now magazine and the SCM Impact e-newsletter will also help you keep up-to-date about changes in the industry.

About the APICS CLTD Examination

The APICS CLTD examination consists of 150 multiple-choice questions, of which 20 are pre-test questions that do not contribute to the total score but are necessary for research purposes. Candidates should answer all exam questions. There is a 3 ½ hour time limit for the exam.

For more information about testing and registration policies and procedures, please visit apics.org/cltd and the APICS Exam Handbook or contact Customer Relations at 1-800-444-2742 (United States and Canada) or +1-773-867-1777.

Question Format

All of the questions on the CLTD examination are intended to test one's understanding of the CLTD body of knowledge. In addition, it is helpful to understand the various formats of questions that a candidate may see. The following three examples illustrate the types of multiple-choice questions found on the examination:

For Example 1, choose the response that best completes the statement.

> Example 1: The 80-20 rule is an application of:
>
> A. statistical process control.
> B. defect measurement.
> C. root cause analysis.
> D. Pareto analysis.
> (The correct answer is D.)

For Example 2, choose the response that best answers the question.

> Example 2: The right of eminent domain is most often used in which of the following modes of transportation?
>
> A. Truck
> B. Water
> C. Pipeline
> D. Air
> (The correct answer is C.)

For Example 3, evaluate the statements and provide the most appropriate response. The answer is not one person's opinion; it is the accepted choice according to the APICS body of knowledge.

> Example 3: The most significant advantage of strategic sourcing is:
>
> A. finding suppliers who can provide materials at lowest cost.
> B. using technology to select low-cost, high-quality sources of materials.
> C. developing long-term supplier relationships.
> D. having a process for recurring transactions with single suppliers.
> (The correct answer is C.)

Taking the Test

The test is designed to evaluate a candidate's knowledge of the subject matter. Therefore, the key to success is a thorough understanding of the subject matter. All questions are based on the current CLTD body of knowledge as defined in the exam content manual.

When you start your exam, read the directions carefully. Be sure you understand the directions before you begin to answer any questions.

Read each question carefully and thoroughly. If a question includes stimulus material such as a table, graph, or situation, be sure to study it before you answer the question. Avoid assuming information not given, assuming you know what is being asked without reading the question completely, or "second guessing" the question. Every effort has been made to avoid misleading wording and to provide sufficient information for each question.

Choose the best answer from the choices given. Care has been taken to avoid misleading choices. Do not look for hidden tricks or exceptions to the norm. For each question, one and only one of the four choices represents the correct answer.

Once you begin the test, approach the questions in order, but do not spend too much time on those that are unfamiliar or seem difficult to you. Go on to the other questions and return to the difficult ones later. If you have some knowledge about a particular question, you may be able to eliminate one or more choices as incorrect. Your score on the test will be based on the number of questions you answer correctly, with no penalty for incorrect answers; therefore, it is to your advantage to guess rather than not answer a question. Avoid changing an answer unless you are absolutely certain you marked the wrong answer.

Interpreting Test Scores

Scoring is based on your correct responses. There is no penalty for incorrect answers. The omission of an answer will be counted the same as an incorrect answer.

The APICS CLTD scaled score range is 200–350.

200 – 299: Fail

300 – 350: Pass

320 and greater: Fellow level

The minimum passing score is 300. You will receive your final exam score along with diagnostic information by topic areas on your performance. All APICS exams use the above scale for communicating scores to candidates. Using a scale is a testing industry best practice and allows scores to be

represented consistently across different forms, or versions, of the same exam. This accounts for variances in difficulty across different exam forms and ensures fairness and accurate reporting to candidates. For more information on Scaled Scoring, please see the following document.

APICS Certified in Logistics, Transportation and Distribution Fellow (CLTD-F)

The distinguishing characteristic of a Certified in Logistics, Transportation and Distribution Fellow (CLTD-F) is the willingness to share acquired knowledge with others through presenting, teaching, publishing and participating in ASCM volunteer activities. This knowledge sharing must take place above and beyond a candidate's normal job duties and be directly related to the APICS body of knowledge.

A current valid CLTD certification is required to be eligible for CLTD-F status. To obtain the APICS CLTD-F designation, an application form must be completed and submitted online to the ASCM corporate office. Points are awarded based on the following criteria: APICS certifications earned (increased for fellow level exam scoring - 320 or greater), presentations, published works, classroom teaching, and ASCM volunteer activities.
To apply for the CLTD-F certification, please visit apics.org/fellow.

Studying for the APICS CLTD Exam

APICS offers several resources to help individuals prepare for the APICS CLTD examination.

APICS CLTD References

Bibliography. The APICS CLTD Examination Subcommittee has identified a number of references for the CLTD examination. These references are used by both the exam sub-committee and CLTD courseware committee in the development of exam questions and preparation materials. These are listed in the Bibliography section of this manual. All the references contain excellent material that will assist in test preparation. For additional information on the APICS CLTD references, visit the APICS website and the CLTD Exam References section, or call Customer Relations at 1-800-444-2742 (United States and Canada) or +1-773-867-1777.

A candidate may discover that the material covered in the chapters of one reference duplicates material covered in another reference. Both sources are included as references to allow candidates some discretion in selecting test preparation materials that they find accessible and understandable.

In deciding if a single reference is sufficient, candidates should assess their own level of knowledge against both the descriptive examination specifications and the detailed topic list contained in the content outline. If there are any areas of weakness, the candidate should consult another reference as part of the test preparation process.

Content outline. The content outline provided in this document should be considered a primary resource for exam preparation. It provides an overview of the major topics included in the exam, as well as a list of the concepts that are relevant to that topic.

APICS Dictionary. The *APICS Dictionary* is an essential reference to the exam content manual and APICS exams. Within the profession, terminology varies among industries, companies, and the academic community. The examination uses standard terminology as defined in the *APICS Dictionary*. Recognizing the terms and understanding their definitions are essential.

Terminology

In studying for the APICS CLTD certification exam, candidates may discover multiple terms used to denote the same technique. An example of this is *customer service ratio* and *fill rate*. APICS has attempted to provide consistency with preferred terminology. However, synonyms are often used by authors in the various references used to compile the body of knowledge. Candidates are encouraged to be familiar with all terms and concepts listed within the outline and key terminology section, using the *APICS Dictionary* as the primary guide for definitions.

Additional Resources for APICS CLTD Candidates

In addition to the cited references, it may be helpful for you to pursue chapter-sponsored courses, college courses, APICS workshops, self-study courses or courses offered by the APICS network of international partners as a means of learning the body of knowledge tested in the certification program. A wide variety of courses and materials are available. As with any investment, you should research the various learning options before choosing one.

APICS CLTD Learning System

The APICS CLTD Learning System is a comprehensive professional development and certification preparation program. This self-directed program combines print material and online interactive tools. This system is also offered in instructor-led formats.

The APICS CLTD Learning System does not "teach the test" and in many areas *reviews* concepts but does not teach concepts. The APICS CLTD Learning System provides a thorough review of the subject matter, but it should not be used without the most current APICS CLTD Exam Content Manual as a means to direct the candidate's study. There will likely be some content in the APICS CLTD Learning System not covered by the exam; conversely, there will likely be some content in the exam not covered by the learning system. Thus, it is essential for candidates to use the current exam content manual in their studies.

APICS CLTD Instructor-Led Review Courses and Educational Programs

The instructor-led format combines the APICS CLTD Learning System print and online components with the leadership of a qualified instructor; peer collaboration; company networking; and a structured, set schedule to keep participants on track. Learn more about APICS recognized instructors at apics.org/recognizedinstructors or find local APICS partners that provide APICS CLTD courses at apics.org/learning-opportunities.

ASCM also offers a variety of educational programs. For a complete list of learning opportunities and resources, please visit ascm.org or contact Customer Relations at 1-800-444-2742 or +1-773-867-1777.

Job Task Analysis

The subject matter in the CLTD exam content outline is created and validated by means of a Job Task Analysis (JTA) study. A JTA is a process of creating a survey to analyze which tasks within a specific role are most important. They are used in the credentialing industry to create and validate certification programs and their content by ensuring that the respective bodies of knowledge are applicable and up-to-date with current industry standards and trends.

In following testing industry standards and best practices, ASCM regularly conducts a JTA for each of its certifications. For the CLTD

program, this process involves bringing together a task force of industry-specific professionals that represent a diverse set of logistics, transportation, distribution and operations industries. These professionals, under the guidance of a third-party psychometrician, work to identify the knowledge, skills and tasks deemed important in the practice of logistics and distribution. These inputs are then used to create a survey that is distributed to supply chain professionals globally to validate the content identified by the task force. The results of this industry-wide survey are then analyzed by the task force, resulting in a recommendation to the CLTD Exam Subcommittee for content updates.

The JTA process is vital to all high-stakes certifications, as it validates the existing body of knowledge (BOK) and identifies new areas for addition and updates to ensure that the content is at the cutting edge of the industry. The last JTA update for the CLTD program took place in 2019. This update was based on the results of a survey that was responded to by over 2,800 industry professionals, representing a diverse mix of job functions, industries, organization sizes, work experience and countries of residence.

Exam Content vs. Courseware

Certification has a very different purpose than education. Its purpose is to determine whether a candidate meets a minimum set of requirements in relation to a body of knowledge. Certification examinations test an individual's knowledge and ability to apply that knowledge to specific situations. Exam questions frequently require the candidate to select the best of the four choices, complete a calculation based on the information given or ask the candidate to illustrate their understanding of a concept, process or procedure. While some exam questions may simply ask the candidate to demonstrate their recollection of knowledge from the content outline, they will more often require the candidate to apply the body of knowledge by evaluating and/or analyzing a scenario and determining the best solution. These questions will frequently require the candidate to make finer distinctions than the exercises or items presented in a review course.

APICS uses a rigorous process for creating its certification exams and courseware. Exams and study materials are developed separately to maintain the integrity of the exam process.

APICS exam committees define the contents of the Exam Content Manual (ECM), which determines the areas that will be tested in APICS certification exams. The ECM defines the body of knowledge that can be tested, and every exam question is linked to the ECM content. The APICS exam committees also select the references that will be used for exam development. Additionally, the committees work with ASCM staff in the creating and maintenance of exam forms.

A separate courseware committee, along with ASCM staff and a third-party vendor, create the Learning Systems using the ECM and the recommended references.

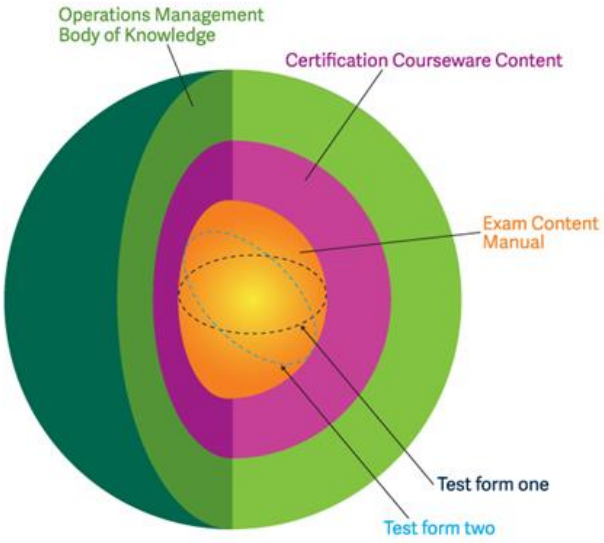
Questions and answer sets for APICS exams are written by exam committee members, who are subject matter experts, and volunteers who have earned APICS certification designations. The exam committees must identify the specific entry in the ECM that is being tested and one or more of the references listed in the ECM that supports the correct answer. All exam questions and answers are reviewed and typically revised by APICS exam committee members. Exam committees, ASCM Test Development staff and a third-party exam development contractor all review the potential test questions for correctness of format, spelling and grammar.

A potential test question may be reviewed multiple times before it actually appears on an examination. Potential test questions initially appear on exams in what is referred to as "pre-test" status in order to collect statistics

on the questions. It is not until a question is deemed to be statistically valid that it will appear as a scored question on an examination.

Because each test form has a limited number of questions, it samples representative areas of the body of knowledge as defined by the ECM. While each test form is different, all areas tested are contained within the body of knowledge as defined by the ECM.

The following graphic is a representation of the type of relationship between the Operations Management Body of Knowledge (OMBOK), courseware / Learning Systems, ECM's and different examinations.



APICS CLTD Certification Maintenance: Continuing Professional Development

The Importance of Certification Maintenance

To promote professional growth and lifelong learning, ASCM requires certification maintenance every five years, beginning on the date the certification is earned.

The growing number of individuals choosing to pursue professional development through the APICS CLTD program indicates a strong awareness that continuing education and skills development are essential to meeting the information and technological challenges in today's rapidly evolving workplace and global marketplace. Professional development opens doors to individual career opportunities and organizational success.

Although APICS CLTD recognition and maintenance are voluntary programs, they equally demonstrate one's commitment to achieving the highest level of professional development and standards of excellence. The APICS CLTD certification maintenance program upholds both the objectives of the APICS CLTD program and the APICS vision to promote lifelong learning. This flexible program recognizes that individuals are at various levels in their careers, come from many industries, have different educational needs and career goals and have varying access to continuing education. Thus, requirements for maintaining certification can be met through multiple sources and a variety of professional development activities. These sources and activities are intended to help prepare for the challenges ahead and maintain a professional edge by:

- preserving the currency of hard-earned certification
- expanding your knowledge of the latest industry practices
- exploring new technology solutions
- reinforcing skills
- improving job performance
- demonstrating commitment to excellence
- increasing competitive advantage

In order to ensure that CLTD certified individuals remain up to date on industry trends and are committed to continued professional growth, certification maintenance is required for their certification to remain active.

For complete details on how to maintain your APICS CLTD designation, please visit apics.org/maintenance.

ASCM Code of Ethics

When you begin the exam registration process, you will be asked to pledge to abide by the ASCM Code of Ethics. Once certified, you pledge to continue your education to increase your contribution to the supply chain management profession. After achieving the CLTD designation, you pledge also to share your knowledge with others by participating in ASCM research and educational activities at local, district, national and international levels.

The ASCM Code of Ethics is as follows:

- Maintain exemplary standards of professional conduct;
- Not misrepresent your qualifications, experience, or education to ASCM or others you serve in a professional capacity;
- Respect and do not violate the United States Copyright of all ASCM materials, including but not limited to courseware; magazine articles and other ASCM publications; ASCM conference presentations; and CLTD, CPIM, CSCP and SCOR-P examination resources. In this same spirit, you must not violate the copyright of other organizations and individuals in your professional capacity;
- Do not engage in or sanction any exploitation of one's membership, company, or profession;
- Encourage and cooperate in the interchange of knowledge and techniques for the mutual benefit of the profession;
- In your professional capacity, respect the fundamental rights and dignity of all individuals. You must demonstrate sensitivity to cultural, individual and role differences, including those due to age, gender, race, ethnicity, national origin, religion, sexual orientation, disability, language and socio-economic status;
- In your professional capacity, not engage in behavior that is harassing or demeaning to others based on factors including, but not limited to, age, gender, race, ethnicity, national origin, religion, sexual orientation, disability, language or socio-economic status;
- Adhere to this Code of Conduct and its application to your professional work. Lack of awareness or misunderstanding of an ethical standard is not itself a defense to a charge of unethical conduct;
- Contact the Ethics Committee when uncertain whether a particular situation or course of action violates the Code of Conduct; and
- Not to become the subject of public disrepute, contempt or scandal that affects your image or goodwill.

Failure to abide by ASCM Code of Ethics policy may result in sanctions up to and including decertification.

Bibliography

All test candidates should familiarize themselves with the following references for this examination. The recommended references pertaining to the diagnostic area are listed at the end of each section of the content outline. The References listed below can be found at apics.org/cltd under the CLTD Exam References section. A complimentary digital copy of The APICS Dictionary is available to ASCM members in the online ASCM Member Benefits section.

	References	Author(s)
1	*APICS Dictionary*, 16th ed., 2019	APICS
2	*Supply Chain Logistics Management. 5th ed.*, McGraw-Hill, 2020.	Bowersox, Donald J., Closs, David J., Cooper, M. Bixby, Bowersox, John C.
3	*Managing Supply Chains – A Logistics Approach. 9th ed.*, South-Western, Cengage Learning, 2013.	Coyle, John J., Langley Jr., John C., Novack, Robert A., Gibson, Brian J.
4	*Transportation – A Global Supply Chain Perspective. 9th ed.*, Cengage Learning, 2018.	Novack, Robert A., Gibson, Brian J., Suzuki, Yoshinori, Coyle, John J.
5	*International Logistics. 5th ed.*, Cicero Books, 2017.	David, Pierre.
6	*Warehouse Management – A Complete Guide to Improving Efficiency and Minimizing Costs in the Modern Warehouse. 3rd ed., Kogan Page Limited, 2017.*	Richards, Gwynne.
7	*Distribution Planning and Control – Managing in the Era of Supply Chain Management. 3rd ed.*, Springer, 2015.	Ross, David F.

APICS Certified in Logistics, Transportation and Distribution (CLTD)

CLTD Subcommittee

Dr. Yemisi Bolumole, Ph.D., CLTD-F, CTL (Chair)
Michigan State University
Nishat Ahmed, CPIM, CIRM, CSCP, CPM, CLTD, SCOR-P, CTL
M.C. Dean Inc.
Louis Francis Carrieri, CPIM, CLTD
Baker Hughes, a GE Company
James Caruso, CPIM, CSCP, CLTD
Dr. Douglas Hales, Ph.D., CTL, CLTD-F
University of Rhode Island
Mark C. Hardison, CPIM-F, CSCP-F, CLTD-F
Mallinckrodt
Scott Lane, CTL, CLTD
Beaver Street Fisheries
Gary A. Smith, CPIM-F, CSCP-F, CLTD-F
New York City Transit Authority

Scope of the Subject Matter

The APICS CLTD certification examination covers concepts, tools and processes which illustrate the supply chain-wide system perspective of logistics. The CLTD certification emphasizes the microanalysis of logistics, distribution and transportation services. Managing the logistics system requires an oversight of transportation, order processing, inventory and the combination of warehousing, material handling and packaging; all integrated through a network of facilities with a goal to support customer service, manufacturing and purchasing operational requirements. The subject matter is organized into nine content areas:

Logistics Overview and Strategy

This section provides an overview of the macro and micro logistics processes and systems which define forward and backward material and information flows in the supply chain. With reference to its primary goal to achieve consistent customer service at the least total cost, this section addresses the synchronized and integrated approach to logistics management. This section illustrates logistics' cross-functional relationships with marketing, finance, risk management and manufacturing operation requirements, showing how logistics "fits" into the totality of business operations and continuity.

Capacity Planning and Demand Management

This section addresses the strategic and operational considerations, and important trade-offs related to translating demand into capacity planning by integrating forecasting, procurement and demand management in terms of their separate and combined impact on logistics requirements. It emphasizes the resource-alignment tasks that define how organizations develop forecasts by which transportation and warehouse considerations are planned and operationalized.

Order Management

This section addresses the related concepts of customer relationship management (CRM), order management and customer service, highlighting the major steps required to manage and execute customers' orders with an emphasis on logistics' key role in influencing customer service. Order management defines and sets the logistics process in motion, while customer service is the task by which logistics outputs are measured and defined.

Inventory Management

With a detailed examination of the related concepts of inventory, this section addresses the various methods and techniques that firms use to control and manage inventory in the supply chain. This section emphasizes the benefits and roles different types of inventory plays in the logistics system. It illustrates the various managerial decisions in planning and maintaining optimal inventory levels including costs, controls and policy.

Warehouse Management

This section focuses on strategies, processes, methods and techniques for the effective and efficient management of the warehouse. Emphasis is on the components of warehouse management that reduce cost and cycle time while increasing accuracy and efficiency.

These include space management, packaging, control systems, storage and retrieval, warehouse ownership, layout, automation, outsourcing strategies and key performance indicators (KPIs).

Transportation Management

This section covers the major principles and processes of transportation management, administration and economics. It addresses the fundamental responsibilities of transportation and traffic professionals. These responsibilities include utilizing the optimal mode of transportation to position inventory throughout the supply chain and executing transportation management functions which include carrier selection and negotiations, routing optimization, documentation, auditing and claims administration and specialized transport related services.

Global Logistics

With an emphasis on the more complex analyses required to navigate today's global logistics landscape, this section addresses the rules, processes and techniques that logistics professionals need to succeed in global supply chains. It includes an understanding of transportation mode analysis, financing options, security considerations and regulations, duties, documentation and restrictions that define the global operating environment.

Logistics Network Design

This section addresses the transportation and inventory economies that critically define logistics network design considerations. It includes an introduction to the modeling tools and techniques which enable supply chain spatial and temporal integration, addressing the need for today's logistics professionals to extend this responsibility to include the processes, resources and tools for managing risks.

Sustainability and Reverse Logistics

This section addresses the expanded view of reverse supply chain flows to incorporate a general overview of sustainability. It includes a focus on the key factors and activities that define reverse logistics processes and logistics social responsibility considerations with triple bottom line implications.

The successful candidate will be able to understand the leadership responsibility of logistics to design and administer systems to control the movement and positioning of material and information flows, to satisfy customer requirements at the least total cost. Based on an understanding of the processes, best practice methods and tools used by today's logistics managers, the successful candidate will be able to define the actions necessary to implement selected solutions to address specific supply chain situations and opportunities. This includes an understanding of, and the ability to manage:

- the major inputs and outputs of the logistics systems with an emphasis on its value-creating role within the supply chain
- the interdependent components within the logistics system and between logistics and other business functions in the supply chain
- an integrated logistics facility network design strategy that includes an understanding of tradeoffs that influence total logistics costs
- the effect of variance in a logistics system and how collaborative processes and relationships provide mechanisms to minimize these variances while reducing operations costs, enhancing productivity and meeting customer requirements
- the changing role of various stakeholders and trading partners which define the increased complexity of managing logistics within the current global marketplace.

In addition, the candidate preparing for the APICS certification examination must have a fundamental understanding of the following key business concepts:

- Business acumen (qualitative skills, math, statistics)
- Ethical considerations
- Leadership

APICS CLTD 2.0 Content

Nine content areas have been designed to organize the APICS CLTD domains. The relative importance of these topics will vary among industries, but the figures given below show the percentage designated for each section on the exam. These percentages are based on the results of the Job Task Analysis (JTA) Survey referenced on page 5 of this document.

Diagnostic area	Main topic	Percentage of exam
I	Logistics Overview and Strategy	8%
II	Capacity Planning and Demand Management	9%
III	Order Management	10%
IV	Inventory Management	11%
V	Warehouse Management	13%
VI	Transportation Management	17%
VII	Global Logistics	15%
VIII	Logistics Network Design	10%
IX	Sustainability and Reverse Logistics	7%

Content Outline

I. Logistics Overview and Strategy

Logistics is the core of supply chain management. Fundamental concepts include managing logistics as a cohesive system, understanding tradeoffs to present a logistics strategy that aligns with organizational strategy and finding the most effective mix of revenue producing services for the cost of providing that service. Measurement and continuous improvement are emphasized as ways to meet and exceed the pressures of globalization and the steadily increasing customer expectations for logistics.

A. Logistics Fundamentals

It is important to understand the scope of logistics, including how it fits within the larger role of supply chain management and business strategy. The concept of tradeoffs is used to show how interconnected the various areas of logistics really are, while a review of logistics' process flows puts things into a different perspective. Achieving the full value of logistics requires a balance between costs, customer satisfaction and service levels. Emphasis is given to an understanding of why methods of accounting for logistics costs is important for logistics management and overall business success.

Knowledge and skills in this area include:

1. Logistics introduction
   a. Definitions
   b. Scope of logistics
   c. Principles and components
   d. Drivers

2. Supply chain management and the role of logistics
   a. Economic impact of logistics
   b. Effects of globalization and e-commerce

3. The value of logistics management
   a. Creating competitive advantage
   b. Reducing transportation, labor and inventory costs
   c. Increasing customer satisfaction and service levels

B. Logistics Strategy within the Supply Chain

The many aspects of logistics strategy include altering tactics to account for product life cycle stages, finding the right balance between services and their costs, fitting in with existing organizational structures, developing strong relationships at the appropriate level, assessing strategic level risks including security and designing the right key performance indicators to encourage desired behavior.

Knowledge and skills in this area include:

1. Goals and objectives, service levels
2. Value proposition and creation
3. Product life cycles
4. Cost and service optimization
   a. Transportation/warehousing
   b. Inventory (space)
   c. Labor
   d. Technology
   e. Budget and payment terms
5. Organizational design and supply chain synchronization
6. Logistics relationships and interdependencies
7. Risk management
   a. Identifying and managing exceptions
   b. Strengths, weaknesses, opportunities and threats (SWOT)
   c. Logistics, Transportation and Distribution (LTD) continuity plan
8. Supply chain security
9. Segmentation
10. Talent acquisition and management
11. Performance management and Key Performance Indicators (KPIs)
    a. Continuous improvement philosophy

References: 1; 2 (chapters 3, 12, 13, 14); 3 (chapters 2, 3, 4); 7 (chapters 1, 3, 4)

Note: *The first number indicates the sequence number for the reference in the bibliography section and the numbers in parentheses indicate the relevant chapters within that reference.*

II. Capacity Planning and Demand Management

Logistics capacity planning and related decisions rely on efficient forecasts, so it is important to understand the concepts behind forecasting and its application to logistics decisions. This involves understanding how logistics can help direct and prioritize in order to better match supply to demand. The effective acquisition of inventory also requires a collaboration between procurement and logistics.

A. Balance demand management with LTD capacity (long, medium, short-term)

Logistics professionals need an understanding of the concepts behind forecasting, especially the resource-alignment tasks through which organizations develop forecasts by which logistics, manufacturing, purchasing and other departmental plans are created.

Knowledge and skills in this area include:

1. Forecasting process
   a. Forecasting methods
   b. Channels (Business to Business B2B; Business to Consumers - B2C)
   c. Interpreting forecasts (errors, gap, analysis, time series components etc.)

B. Translating Demand into Capacity Planning

Practitioners use forecasts or other demand information and translate it into high-level capacity plans for warehousing and transportation to deliver customer service at a consistent level.

Knowledge and skills in this area include:

1. Transportation capacity planning
   a. Transport decisions (mode, carrier, route selections)
   b. Inbound capacity
   c. Outbound capacity
   d. Load planning
   e. Improve and optimize through constraint management

2. Warehousing considerations
   a. Storage
   b. Equipment
   c. Labor
   d. Throughput (constraints)

C. Demand Management

In its cross-functional interrelationships with sales, marketing, purchasing and manufacturing operations, logistics works to orchestrate and coordinate demand and supply in order to resolve interface conflicts by systematically considering plausible trade-offs. This requires an understanding of processes including sales and operations planning (S&OP), master scheduling, master production schedule (MPS), materials requirement planning (MRP) and distribution requirements planning (DRP).

Knowledge and skills in this area include:

1. Demand forecasting

2. Capacity planning

3. Demand shaping

D. Sourcing and Procurement

Logistics needs to closely coordinate its activities with procurement to ensure a stable source of supply at reasonable total logistics system costs. This involves the procurement processes of selecting suppliers and generating contracts with the appropriate terms and conditions, which ensure performance is adequately monitored and controlled.

Knowledge and skills in this area include:

1. Purchasing strategy
   a. Make-or-buy decisions
   b. Warehouse capacity constraint
   c. Transportation capacity constraint
   d. Supplier selection
   e. Contract terms and conditions

2. Performance management (KPIs)

References: 1; 2 (chapters 5, 6, 7); 3 (chapters 7, 9, 11, 13, 14); 4 (chapter 7); 7 (chapters 5, 6, 11, 13)

III. Order Management

At the core of the logistics process is the customer order, which serves as the trigger setting logistics in motion. Order management activities include a variety of tasks aimed at planning, designing and controlling processes which manage and execute customers' orders. At the core of these processes is customer relationship management since every decision and activity that logistics takes should be with the customer in mind. By developing a customer service management strategy, logistics can deliver on the seven rights of customer service which enhances long-term customer satisfaction and creates lifetime customers.

A. Customer Relationship Management (CRM)

CRM is an important marketing philosophy that emphasizes all customers as being top priority, including internal customers or end consumers. By implementing the steps of a CRM process, relationships with key stakeholders can be optimized throughout each transaction.

Knowledge and skills in this area include:

1. Implementing the CRM process

2. Trade-off analysis

3. Customer segmentation

4. Customer service management (CSM)

B. Order Management

Logistics professionals work closely with procurement specialists who source required materials and components from suppliers for the manufacture of products. Once the purchase order processing is completed, logistics confirms the goods received match the original order and a routing guide is used to assist in the multiple decisions that must be made.

Logistics relies on systems, such as Electronic Data Interchange (EDI) and transportation management systems (TMS) which enable order visibility to identify the status of any customer order and to coordinate complex inbound flows, intracompany movements and outbound orders. Supplier and carrier performance is tracked and measured so that improvements can be made on an ongoing basis, making logistics more efficient and effective.

Tailoring, aligning and managing relationships with the supply chain partners will enhance the performance of the entire supply chain.

Knowledge and skills in this area include:

1. Inbound order management
    a. Logistics role in supplier relationship management (SRM)
        1. Vendor-managed inventory (VMI)
    b. Inbound process
        1. Information flow
        2. Lead time
    c. Advance ship notice (ASN) process
    d. Packaging requirements
    e. Order tracking, receipt and confirmation
    f. Transportation plan
    g. Freight forwarders
    h. Performance Management (KPIs)

2. Intracompany orders

3. Outbound order management
    a. Order cycle time
    b. Order cycle stages
    c. Exceptions and change management
    d. Freight terms

4. Order fulfillment channels
    a. Omni-channel
    b. E-commerce
    c. Direct to store
    d. Direct to consumer

References: 1; 2 (chapters 3, 4, 13); 3 (chapters 7, 8); 7 (chapters 10, 11)

IV. Inventory Management

Inventory management involves maintaining inventory levels in a manner that aligns with the business strategy and goals, supporting the coordination of supply and demand, while protecting inventory value. Within the logistics environment, the effective management of inventory takes on added importance because of its direct impacts on service levels, working capital and return on asset investments. Like most things within the logistics systems, decisions regarding inventories must take the tradeoffs between costs and service levels into consideration.

A. Inventory Management in Logistics

To fulfill its basic functions, inventory resides at many points in the supply chain. Excessive levels of inventory create additional costs for the organization, exposure to risk in fluctuations and changes in customer demand. Because of its critical impact on the bottom line, effective inventory management is now seen as a way to create value in the business. It is more imperative than ever to understand the unique role that inventory plays in the business strategy.

Knowledge and skills in this area include:

1. Role of inventory management
    a. Decouple supply and demand
    b. Support service levels
    c. Support total cost objectives

2. Inventory types
    a. Raw materials
    b. Work in process (WIP)
    c. Finished goods

d. Maintenance, repair and operating (MRO) supplies
e. Pipeline stock (in-transit inventory)

3. Functions of inventory (classifications)
   a. Anticipation
   b. Cycle stock/lot size
   c. Safety stock
   d. Hedge
   e. Decoupling

B. Inventory Management Methods

Managing inventory effectively requires meeting competing goals to minimize inventory costs and maximize customer/consumer service. A clear understanding of what contributes to inventory carrying costs is, therefore, a prerequisite to crafting an appropriate inventory management strategy. These costs can be controlled through more effective approaches to inventory ordering that minimize the amount of time inventory resides in the pipeline, which reduces the risk of accumulating excess and potentially obsolete inventory.

Knowledge and skills in this area include:

1. Costs of Inventory
   a. Ordering costs
   b. Setup costs (one-time costs vs overhead costs)
   c. Inventory carrying costs
   d. In-transit costs

2. Order quantity

C. Inventory Control, Strategy, and Policy

Maintaining optimal inventory levels includes the related replenishment questions of "how much to order" and "how often to order." The answers help create an inventory control approach that is both economical and service-oriented. Inventory control also requires deciding when to order, which in turn requires considering issues such as lead times, supply risk and inventory review. Inventory control approaches focus on increasing the rate of inventory turnover and helping the business capture the value of inventory investments more quickly.

Knowledge and skills in this area include:

1. When to order
   a. Reorder point (ROP)
   b. Period order quantity (POQ)

2. How much to order
   a. Economic order quantity (EOQ)
   b. Lot-for-lot (L4L)
   c. Min-max system

3. Manage exceptions, anomalies, constraints and conditions of uncertainty

4. Inventory auditing
   a. Segmentation / ABC analysis / classification
   b. Physical inventory
   c. Cycle counting

5. Performance metrics (inventory turnover, stock outs, carrying costs, forecasting error, etc.)

References: 1; 2 (chapter 7); 3 (chapter 2, 9); 5 (chapter 18); 6 (chapters 1, 3 – 10, 14, 16); 7 (chapters 7, 8, 9, 12)

V. Warehouse Management

Warehouse management entails the movement of materials and goods into and out of storage efficiently, safely and with minimal inventory damage. Supporting the logistics systems' goal of time and place utility, warehouses enable synchronized storage, consumption and transportation activities within the supply chain. As business practices and technology evolve, warehouse management strategies must adapt to new distribution channels and customer/consumer expectations by creating new processes that deliver the desired results.

Knowledge and skills in this area include:

A. Warehouse Strategy, Ownership Types and Roles

Warehouse management strategy aims to deploy the firm's warehousing assets and skills to advance the business goals. The warehouse strategy must be aligned with the corporate strategy and objectives and also with the organization's supply chain strategy, which defines the role of each warehouse, including its location, size and capabilities. Understanding the role of warehouses in the supply chain and within the firm's business strategy is the foundation of effective fulfilment processes. Ownership considerations support a responsive approach to changing business environments and enables organizations to maintain optimal facility location and performance.

Knowledge and skills in this area include:

1. Role of warehousing
   a. The economics of warehousing
   b. Challenges of warehousing
   c. Warehouse and inventory policy

2. Ownership types
   a. Private
   b. Public
   c. Contracted
   d. Bonded

3. Uses/roles of warehouses

4. Specialized warehouse services
   a. Climate-controlled
   b. Bonded, duty paid
   c. Hazmat
   d. Automated capabilities

5. Warehousing strategies
   a. Outsourcing / 3PL
   b. Value-added warehousing

B. Warehouse Processes, Layout and Automation

Warehouse management strategy is implemented through efficient and effective warehouse processes, along with a safe and efficient warehouse layout that supports warehouse operations and technology. The execution of warehousing activities and processes set the stage for the day-to-day facility operations. Product handling, storage and support functions provide key coordination between key processes and members across the supply chain while maximizing returns on the organization's inventory investment. Beyond basic product flows, warehouses support the timely and accurate flow of information within distribution facilities as well as across the supply chain. The use of appropriate warehouse technology enables distribution control and effective decision making within the supply chain.

Knowledge and skills in this area include:

1. Warehouse processes and order flow
   a. Receiving
   b. Storage
   c. Picking and packing - first in, first out (FIFO); last in, first out (LIFO)
   d. Consolidation
   e. Loading
   f. Shipping
   g. Replenishment

2. Facility layout decisions
   a. Size of facility
   b. Types of layouts
   c. Optimizing throughput, space and capacity

3. Warehouse automation and systems
   a. Warehouse management systems (WMS)
   b. Yard management system (YMS)
   c. Enterprise resources planning (ERP)
   d. Automated storage and retrieval systems (AS/RS)

4. Documentation

5. Performance management (KPIs)
   a. Throughput
   b. Quality
   c. Capacity
   d. Productivity

e. Customer service
f. Audits

C. Material Handling and Packaging

High-performing material handling protocols represent significant cost savings and service improvement opportunities. Material handling, unit containerization and packaging represent integral parts of the integrated logistics systems with their significant impact on its cost and productivity capabilities. The facility considerations of material handling and packaging thus ensures handling efficiencies as well as customer-friendly product unitization and protection. With the increased use of automation and information technology applications within warehousing and material handling operations, supply chains are discovering new ways to reduce labor costs with promising improvements on service quality.

Knowledge and skills in this area include:

1. Packaging fundamentals
    a. Product characteristics, primary vs. secondary packaging requirements
    b. Unitization & unit loads
        1. Returnable containers
        2. Pallets & slip-sheets
        3. corrugated

2. Materials handling
    a. Equipment
        1. Manual & mechanical
        2. High level order pickers
        3. Sortation systems
    b. Layout
        1. Storage
        2. Picking
        3. Receiving
        4. U Flow / Flow through
    c. Slotting strategy (e.g. random, dynamic)
    d. Health and safety, security

References: 1; 2 (chapters 1, 3, 7, 9, 11); 3 (chapters 9, 11, 14, 16); 6 (chapters 1, 3 - 10, 12 - 16); 7 (chapters 7, 12)

VI. Transportation Management

Transportation moves goods and services across geographic lines, between where products are produced and where they are consumed, while allowing for competitive growth. At home and abroad, advances in transportation through technology and design have broadened the markets for both domestic and international competition. The wider a product's distribution and the greater its demand, the more manufacturers can leverage transportation's economies of cost. Logistics professionals are responsible for moving inventory throughout the firm's supply chain and to the firm's customers. They can use a combination of private and purchased transportation services with access to various modes of transportation, offering flexible solutions for transporting product from origin to destination.

A. Transportation Fundamentals

Transportation systems connect the various supply chain components and must be properly managed and controlled with complete visibility and strong communication between multiple stakeholders and transportation managers. Proactive transportation management is critical to an efficient and economical operation and should be considered when a company plans organizational and supply chain processes. An integral part of logistics, the transportation process, represents one of the largest portions of a logistics manager's budget.

Knowledge and skills in this area include:

1. Transportation cost structure
    a. Terminals
    b. Vehicles

2. Transportation stakeholders
    a. Shipper (consignor)
    b. Recipient (consignee) of transported goods
    c. Carrier of goods and agents
    d. Government
    e. Public

3. Transportation capabilities/intermediaries
    a. 3PLs and 4PLs
    b. Freight forwarders
    c. Freight brokers
    d. Customs broker
    e. Export management companies (EMC), Export trading companies (ETC)
    f. Shipping associations
    g. Agents
    h. Export packing companies
    i. Selection considerations

4. Carrier Types
    a. Common
    b. Contract
    c. Exempt
    d. Private carriers
    e. Selection considerations

B. Modes of Transportation and Selection Considerations

Transportation consumes time, financial and environmental resources. Understanding the characteristics of the different transportation modes enables managers to make appropriate selections based on relative modal performance in terms of speed, availability, dependability, capability, frequency and cost. Intermodal transportation combines two or more modes to execute the shipment process and represent a key means of transportation service.

Knowledge and skills in this area include:

1. Road
    a. Trailer types (Container on a flatcar (COFC), Trailer on flatcar (TOFC), etc.)
    b. Freight classification (Truckload (TL), Less-than-truckload (LTL) etc.)
    c. Market structure and sales strategy
    d. Operating and service characteristics
    e. Issues and challenges

2. Rail
    a. Types of carriers/freight (TOFC, COFC, etc.)
    b. Container types
    c. Market structure and sales strategy
    d. Operating and service characteristics
    e. Issues and challenges

3. Air
    a. Types of carriers
    b. Container types
    c. Market structure and sales strategy
    d. Operating and service characteristics
    e. Issues and challenges

4. Water (ocean or waterways)
    a. Freight classifications (Full Container Load (FCL), Less than Container Load (LCL), etc.)
    b. Vessel type
    c. Market structure and sales strategy
    d. Operating and service characteristics
    e. Issues and challenges

5. Pipeline
    a. Types of freight
    b. Market structure and sales strategy
    c. Operating and service characteristics
    d. Issues and challenges

6. Intermodal and multi-modal transportation, multi-stop
    a. Types of carriers
    b. Freight classification (FCL, LCL, etc.)
    c. Market structure and sales strategy
    d. Operating and service characteristics
    e. Issues and challenges

7. Courier and parcel services
    a. Types of carriers

b. Market structure and sales strategy
c. Operating and service characteristics
d. Issues and challenges

8. Market structure and sales strategy
   a. Issues and challenges

C. Transportation Management

Transportation management usually covers two areas: inbound and outbound flows. Transportation management's goal is to reduce transportation costs and increase delivery reliability through collaboration between all participants in the transportation transaction: carriers, providers and non-vessel operating agents. Transportation managers must effectively manage the entire transportation process—from long-range strategies and operational planning to day-to-day execution.

Knowledge and skills in this area include:

1. Transportation network design and mode selection
   a. Routing analysis and optimization
   b. Trade-offs in transportation design
   c. Utilize data driven business intelligence

2. Carrier negotiations and selection
   a. Selection factors
   b. Outsourcing considerations
   c. Request for proposal / Request for quotation (RFP/RFQ) process
   d. Contracts
      1. Master contracts
      2. Purchase orders
      3. Templates, key sections
      4. Best practices

3. Fleet Management and Optimization

4. Rate tariffs
   a. Manual vs. automatic
   b. Standardize charges
   c. Rates per mode
   d. Drivers
   e. Contract types and rates

5. Documentation
   a. Terms of sale
   b. Master bill of lading
   c. House bill of lading
   d. Freight bill
   e. Freight claims
   f. Proof of delivery (POD)

6. Tracing, tracking, expediting, consolidation, and metrics
   a. Timeline vs. location
   b. Optimization
   c. Electronic data interchange (EDI)
   d. Exception management

7. Routing and billing, demurrage (dwell)

8. Special product considerations

9. Transportation cost forecasting and budgeting
   a. Economic considerations
   b. Market considerations
   c. Security considerations
   d. Regulation requirements

10. Freight settlement

References: 1; 2 (chapters 3, 8, 11); 3 (chapter 10); 4 (chapters 2 –11); 5 (chapters 4, 6); 7 (chapter 13)

VII. Global Logistics

For the global logistics manager, successful participation in international trade requires awareness and knowledge of a number of key components, including but not limited to:

- the infrastructure and systems of the countries to which it will export goods
- the regulations which govern each country that its shipments will travel through
- the customs clearing and documentation requirements for each shipment as dictated by each country and transportation mode used
- an understanding of how it can reach mutual agreement on the terms of sale, methods of payment and finance terms trade participants; and

- the process of determining the currency to be used for payment, transfer pricing and potential understanding of how free/foreign trade zones (FTZ) influences duties paid and total landed costs. Coordinating these international trade elements is an essential skill set for today's logistics professionals.

A. Infrastructure and System

By identifying the macroenvironmental factors of global logistics that impact countries and organizations around the world, logistics professionals can be better prepared to manage their array of service providers, related transportation costs and substitute product offerings. A variety of important international trade theories and practices, as well as discussion of the relative quality and quantity of transportation infrastructures across modes and countries provide a solid historical and geographic perspective of the many components that impact global trade today.

Knowledge and skills in this area include:

1. Macroenvironmental factors influencing international logistics

2. International Infrastructure
   a. Transportation
   b. Utilities
   c. International trade specialists

3. Performance management
   a. Lead time considerations
   b. Risk and exception management

B. Regulations

Virtually every aspect of international trade is governed by regulations created by the government of each country through which a shipment will pass. With most international transactions, product shipments typically pass multiple borders, thus increasing the complexity of required documentation, safety and security measures and involvement of logistics and trade specialists. Trade agreements and trading blocs can be used to facilitate international trade by mitigating against some of these complex procedures. Navigating the various changing export restrictions and lists of restricted/denied parties requires a working knowledge of each country's current regulations, quotas, control lists, and end use certificates.

Knowledge and skills in this area include:

1. International trade
   a. Trade agreements
   b. Trading blocs
   c. Trade compliance

2. International transportation regulations
   a. Government policies and regulations
   b. International Air Transport Association (IATA)
   c. Anti-bribery and corruption practices

3. Transportation safety
   a. Labor safety regulations
   b. Standards for equipment and vehicles
   c. Dangerous goods and hazardous materials
   d. Environmental
   e. Security

4. Methods of entry
   a. Import/export regulations
   b. Export restrictions

C. Customs Clearing and Documentation

Today's logistics managers must be knowledgeable in preparing all the required documentation needed by customs to ensure that the customers' shipments arrive safely, securely, without damage and on time at their final designation. Ease in using the Harmonized System Classification codes is vital to properly specifying the goods for export and each code assignment ultimately dictates the tariff rate charged for those products.

Knowledge and skills in this area include:

1. Invoices
   a. Commercial invoice

b. Pro forma invoice
c. Consular invoice

2. Import documents (sales documents)
   a. Certificate of origin
   b. Certificate of manufacture
   c. Certificate of inspection
   d. Certificate of free sale
   e. Import license
   f. Certificate of insurance
   g. Carnet

3. Export documents
   a. Shipper's export declaration (SED)
   b. Export license

4. International transportation documents
   a. International bill of lading
   b. Ocean bill of lading
   c. Air waybill (AWB)
   d. Road waybill
   e. Rail waybill
   f. ATR certificate
   g. Packing list

5. Customs clearance
   a. Duty
   b. Harmonized system of classification
   c. Valuation
   d. Tariffs
   e. Customs brokers

D. Finance and Payment Options

Global trade can often associate with higher levels of financial risks as a result of the many unknown variables that can impact international transactions. All parties must evaluate their risk of exposure and identify which financing and payment options are most appropriate and amenable to the parties involved. There must be agreement on all the terms of sale and the method and timeframe of payment. Familiarity with International Commercial Terms, also known as Incoterms®, is essential to clarifying and understanding how responsibilities are assigned between buyers and sellers in each transaction.

Knowledge and skills in this area include:

1. Terms of sale
   a. Contract terms and conditions
   b. Incoterms®

2. Methods of payment
   a. Cash in advance
   b. Letter of credit
   c. Bills of exchange
   d. Open account

E. Currency and Tax Considerations

Similar to the selection of terms of sale and financing, global trade participants must decide which currency will be most appropriate for payment, based on the convertibility of the selected currency and the risk of fluctuation. As trade participants individually strive for sustained profitability, this must be appropriately balanced with levels of risk exposure between buyers and sellers. Related options such as use of foreign trade zones and transfer pricing can lessen or mitigate these risks exposures.

Knowledge and skills in this area include:

1. Currency translation

2. Transfer pricing

3. Free/foreign trade zones (FTZ)

References: 1; 2 (chapter 10); 3 (chapter 3); 4 (chapters 1, 7, 9, 10, 11, 12, 14); 5 (chapters 1, 2, 3, 4, 6, 7, 8, 9, 11, 12, 13, 15, 16, 17, 20); 7 (chapters 13, 14)

VIII. Logistics Network Design

The design of the network of warehouses and transportation lanes enables an effective match of supply with the place and time of demand. This involves choosing the optimal number, location and type of warehouse facilities, which can be supported by using both manual and automated decision support tools. Risk management helps logistics professionals determine how they can help

minimize uncertainty and provide more reliable organizational results.

A. Facilities Planning

Several factors need to be weighed to determine the proper location, number and type of warehouse facilities given the trade-offs with transportation. This requires a detailed analysis of transportation and distribution requirements, while understanding the key trade-offs inherent in planning and deploying an optimized network.

Knowledge and skills in this area include:

1. Transportation requirements
   a. Business strategy
   b. Analysis of transportation requirements for customer
   c. Trade-offs
   d. Inventory location and levels, order size and frequency

2. Facility location decisions
   a. Types of distribution networks
   b. Deployment considerations/factors
   c. Location techniques

3. Determining appropriate facility type

B. Distribution Network Design

Logistics professionals should follow a process to make the complex activities of network design easier to navigate, including understanding the various factors to consider when selecting a particular facility location. Distribution network design involves employing modeling techniques, such as heuristic, optimization and simulation tools designed to help find the right balance among the competing needs of the multiple stakeholders involved in a modern logistics network.

Knowledge and skills in this area include:

1. Logistics network design process

2. Locational determinants – key factors
   a. National/regional
   b. Site-specific

3. Modeling approaches
   a. Optimization
   b. Simulation
   c. Heuristic

C. Risk Management

Risk management is a vital part of network design and must be included in order to make the network resilient and resistant to customer, financial, regulatory, security, hazard, business interruption and other types of vulnerabilities. It is important for logistics professionals to learn the risk management process for identifying, prioritizing and appropriately responding to each risk. These plans can include prevention or mitigation plans, as well as providing business continuity if a risk event occurs. Logistics requires an understanding of the types of insurance that can be acquired and the associated benefits and limitations. The amount of insurance obtained needs to be measured against risk levels to make sure that the investment in insurance is appropriate for the business situation.

Knowledge and skills in this area include:

1. Types (customer, financial, regulatory)
   a. Mode selection
   b. Choosing your carrier
   c. Warehouse strategy
   d. Build redundancy
   e. Weather/environmental
   f. Supplier failure
   g. Avoid unnecessary costs
   h. Visibility

2. Risk management process

3. Security
   a. International organizations
   b. Different country approaches

4. Business continuity planning

5. Packaging options

6. Insurance

D. Performance Management

1. Analytics
2. Benchmarking
3. Cost/finance
4. Forecasting

References: 1; 2 (chapters 3, 11, 14); 3 (chapter 2, 11, 12); 4 (chapter 10); 5 (chapter 10, 15); 6 (Chapter 1, 9); 7(chapters 3, 4)

IX. Sustainability and Reverse Logistics

Companies around the globe use reverse logistics to manage their product returns in ways that actually turn the reverse flows into quantifiable value streams that not only contribute to the profitability of the organization, but also strengthen its triple bottom line (TBL) and its commitment to sustainability and social responsibility. These efforts make the organization more attractive to customers, suppliers, other supply chain participants and to shareholders who value green initiatives, reduced carbon footprints and wiser usage of the world's finite resources.

A. Reverse Logistics

Logistics is involved in deciding if the firm's reverse logistics strategy can be handled internally by creating a central returns center or by hiring a third-party provider to coordinate the activities. These activities may include recalls, overstocks, reuse, refilling, repairing, remanufacturing, refurbishing, recycling, repurposing, recovery and disposal. The firm must carefully weigh the benefits and challenges it will encounter for each of these sub-processes and develop a comprehensive strategy to master and manage its reverse flow processes and the value stream which will contribute positively to the organization's bottom line.

Knowledge and skills in this area include:

1. Key product factors
2. Reverse logistics activities
   a. Returns, recalls, overstocks
   b. Reusable shipping assets
   c. Reduce/reuse (refilling), repair, remanufacturing
   d. Recycling, repurposing, recovery
   e. Disposal (scrap, salvage)
3. Reverse logistics process
   a. Forward and reverse flow, closed-loop supply chains
   b. Steps to product returns process
4. Optimizing reverse logistics
   a. Reverse logistics costs; strategic view
   b. Avoidance strategies
   c. Key management elements
   d. Key technologies
   e. Benefits
   f. Challenges

B. Sustainability

Logistics plays a critical role in demonstrating social responsibility that is valued by its customers, shareholders and the community. It can impact each dimension of social responsibility, safety, human rights, diversity, philanthropy and ethics by implementing specific tactics in its operations. With these targeted efforts and sustainability initiatives, logistics will impact the organization's triple bottom line (TBL) which measures their economic, social and environmental impact.

A commitment to sustainable processes and practices and choosing suppliers and other supply chain members according to those requirements will help the organization be a good environmental steward for the long-term.

Knowledge and skills in this area include:

1. Logistics social responsibility considerations
   a. Dimensions
   b. Triple Bottom Line (TBL) impacts

    c. Frameworks, standards, and guidelines
        1. United Nations Global Compact
        2. Global Reporting Initiative (GRI)
        3. ISO Standards (ISO 14001, ISO 50001)
        4. Government regulations

2. Sustainability in the supply chain
    a. Carbon footprints and offsets
    b. Green initiatives
        1. Products
        2. Packaging
        3. Warehousing design and layout
        4. Material handling
        5. Transportation mode selection and alternatives
        6. Reducing fuel consumption, alternative vehicle/fuel technologies
    c. Vendor selection
    d. Pricing incentives
    e. Other environmental impacts
        1. Dangerous goods
        2. Hazardous waste
    f. Monitoring and measurement

References: 1; 2 (chapter 14); 3 (chapter 15); 4 (chapter 13); 5 (chapter 2); 6 (chapter 16); 7 (chapter 2)

Key Terminology

An understanding of the following list of terms is recommended. This list is intended to be thorough but not exhaustive. The candidate is also expected to be familiar with the definitions of terms identified in the content outline. Definitions of these terms can be found in the *APICS Dictionary*, 16th edition.

A
Activity-based costing (ABC)
allocation
anti-bribery regulations
asset recovery
automatic identification and data capture (AIDC)
available-to-promise (ATP)

B
backorder
balanced scorecard
barge
bill of lading (uniform)
break-bulk
broker
bullwhip effect

C
cash-to-cash cycle time
center-of-gravity approach
certified supplier
closed-loop systems
collaborative planning, forecasting, and replenishment (CPFR)
commodity rate
container on flat car (COFC)
container security initiative (CSI)
continuous replenishment
cross-docking
cross-docking warehouse
cube rates
cube utilization
customer service ratio
Customs-Trade Partnership Against Terrorism (C-TPAT)

D
demand forecasting
demand planning
demurrage
detention
distribution requirements planning (DRP)
dunnage

E
80-20
embargo
enterprise resource planning

F
fill rate
freight rate

G
gatekeeping

H
Harmonized Tariff Schedule (HTS)

I
inventory shrinkage

L
landed cost
lean six sigma
letter of credit (L/C)
life cycle analysis
line haul

M
master service agreement
motor carrier
multisourcing

N
non-vessel-operating common carrier (NVOCC)

O
order fill rate
order to cash cycle

P
pallet
Pareto analysis
perfect order
pick-to-light
pick-to-voice system
postponement
private warehouse
public warehouse

R
radio frequency identification (RFID)
rail gauge
reorder point (ROP)
routing guide

S
sales and operations planning (S&OP)
seasonality
short-sea shipping
slip sheet
sorting
square root rule
stock keeping unit (SKU)
stowability

T
terms of trade
total cost of ownership (TCO)
trailer on a flatcar (TOFC)
truckload (TL) carriers
twenty-foot equivalent unit (TEU)

Sample Questions

The following ten questions are similar in format and content to the questions on the CLTD exam. These questions are intended for practice—that is, to enable you to become familiar with the way the questions are asked. The degree of success you have in answering these questions is not related to your potential for success on the actual exam and should not be interpreted as such. Read each question, select an answer and check your responses with the explanations on pages 30-31.

1. In its simplest form, logistics:

   (A) is concerned with only the distribution of products.
   (B) is another term for transportation.
   (C) integrates inbound logistics with outbound logistics.
   (D) does not involve customer service.

2. Warehouse management system (WMS) based task interleaving combines:

   (A) Put-away and replenishment operations.
   (B) Replenishment and shipping operations.
   (C) Shipping and put-away operations.
   (D) Receiving and shipping operations.

3. A logistics manager works within a business where transportation capacity is near critical mass. Load planning is inefficient given the increasing volume of loads. Which of the following applications would enable better decision making and efficiency in planning loads?

   (A) Advanced planning and scheduling (APS)
   (B) Distribution requirements planning (DRP)
   (C) Enterprise resources planning (ERP)
   (D) Transportation management system (TMS)

4. Which of the following metrics is considered external thus customer-facing?

   (A) Perfect order
   (B) Line fill
   (C) Inventory turns
   (D) Cycle count

5. Inventory carrying costs generally include:

   (A) Inventory capital, storage, service, and risk costs.
   (B) Inventory capital, order, storage, and setup costs.
   (C) Inventory risk, service, setup, and order costs.
   (D) The fixed costs associated with a company-owned warehouse.

6. Pallet-flow racking is perfect for facilitating:

   (A) last in, first out (LIFO).
   (B) cycle counts.
   (C) first in, first out (FIFO).
   (D) low velocity moves.

7. The standard gauge of most of the world's rails will measure at:

   (A) 4 feet 6 inches.
   (B) 4 feet 8 inches.
   (C) 5 feet 6 inches.
   (D) 6 feet 4 inches.

8. A ship, which is able to carry 6,000 twenty-foot equivalent unit (TEUs), would maximize its capacity by carrying which of the following containers?

   (A) 3,000 20' containers
   (B) 3,000 40' containers
   (C) 1,500 20' and 1,500 40' containers
   (D) 3,000 20' and 3,000 40' containers

9. Which of the following functions are associated with a supply-facing warehouse?

   (A) Manufacturing operations
   (B) Consolidating shipments of finished goods
   (C) Marketing strategies
   (D) Inbound materials and components

10. A marketing initiative increases packaging dimensions for an existing product that remains unchanged. While the larger packaging may increase sales of the product, the impact on sustainability will be that:

    (A) less packaging will be thrown out.
    (B) transportation capacity will be wasted.
    (C) shipment density will increase.
    (D) fewer shipments will be required.

Answers to Sample Questions

Note: References to the content outline appear in parentheses.

1. C (IA1) C is correct because the combination of materials management (inbound logistics) and outbound logistics of physical distribution was a natural progression of the post-deregulation development of logistics during the 1980s. A and B are incomplete perspectives of the system that defines logistics. D is incorrect because customer service is one of the key outputs of the logistics system.

2. A (IB4) A is correct because put-away and replenishment (picking) are typically opposite operations in warehouses. Task interleaving is a WMS-based task that typically combines dissimilar tasks in order to reduce traveling and increase productivity.

3. D (IIB1) D is correct because the planning capabilities of a transportation management system (TMS) assists transportation buyers and managers with key pre-shipment decisions. Critical TMS planning applications include routing and scheduling, load planning and optimization, and appointment scheduling. Advanced planning and scheduling (APS) is a system of techniques that integrates demand, production, and distribution planning during short, intermediate, and long-term time periods. An APS system allocates raw materials and production capacity optimally to balance demand and plant capacity. Distribution requirements planning (DRP) is used to help determine the appropriate level of inventory in order to manage and control replenishment schedules between an organization's manufacturing facilities and its distribution centers. Enterprise resources planning (ERP) systems are multi module application platforms that help organizations integrate information and key business processes via a common software platform and centralized database system.

4. A (IIIA4) A is correct because customer service can be looked at from an internal or external key performance indicator (KPI) perspective. B, C, and D are internal metrics while external metrics include perfect order and order fill rate performance. These external metrics are obvious to the customers and often directly influence customers' sales behavior since they impact customers' perception of the organization's strategies.

5. A (IVB1) A is correct because inventory carrying costs generally include those costs that are only incurred by inventory at rest and waiting to be used, i.e., those costs associated with manufacturing and moving inventory from one point to another within the firm's supply chain. There are four components of inventory carrying costs: capital costs, storage space cost, service costs, and risk costs. The fixed costs associated with a company-owned warehouse (option D) do not vary with volume of inventory manufactured/purchased. Setup costs (options B and C) refer to the expense incurred each time an organization modifies production or assembly processes.

6. C (VC) C is correct because pallet-flow racks are driven by gravity, making them perfect for fast-moving products with a first in, first out (FIFO) stock rotation. Last in, first out (LIFO) would be incorrect since this is typically more feasible with a push-back racking system. The other 2 options of cycle counts and low velocity moves are not relevant options in this case.

7. B (VIB2) B is correct because 4 feet 8 inches is the global standard gauge as about 60% of the world uses this gauge. Answer A would be considered narrow

gauge and answers C and D would be considered broad gauge rail.

8. B (VIB4) B is correct since it equals 6,000 TEU's which would maximize the capacity of the ship. Answers A and C do not maximize the capacity of the ship while D would be over the capacity of the ship.

9. D (VIIIA2) D is correct because supply-facing warehouses are used for incoming material and components into the facility. Options A, B, and C are wrong because they are all associated with demand or outgoing facing warehouses.

10. B (IXB2) B is correct because increasing the package size only creates more wasted space. Fewer products in a shipment mean increased shipments using more fuel. A is incorrect because more packaging will be thrown out. C is wrong because shipment density will decrease, not increase. D is also wrong because more shipments are needed due to reduced density.

About APICS and ASCM

For more than 60 years, APICS certifications and training have demonstrated a commitment to global supply chain excellence – achieved one person at a time. APICS CPIM, CSCP and CLTD are now part of the Association for Supply Chain Management (ASCM), the largest non-profit association for supply chain professionals. ASCM is proud to offer the globally recognized certification programs you've come to trust.

APICS

ASCM ASSOCIATION FOR SUPPLY CHAIN MANAGEMENT

Stock #09160-V20E