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EXAM CONTENT MANUAL

CTSC

CERTIFIED IN TRANSFORMATION FOR SUPPLY CHAIN



APICS Certified in Transformation for Supply Chain (CTSC) Exam Content Manual

Version 1.0

ASCM staff has taken care to ensure that the contents of this exam content manual are accurate and up to date at the time of publication. However, any corrections can be found on the ASCM website at [ascm.org/ecmerrata](https://www.ascm.org/ecmerrata).

The references in this manual have been selected solely based on their educational value to the APICS CTSC certification program and 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. Internet links for various bibliographic references can be found on the ASCM website at [ascm.org/ctsc](https://www.ascm.org/ctsc).

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The Association for Supply Chain Management (ASCM) is the global pacesetter of organizational transformation, talent development and supply chain innovation. As the largest association for supply chain, ASCM members and worldwide alliances fuel innovation and inspire accountability for resilient, dynamic and sustainable operations. ASCM is built on a foundation of world-class APICS education, certification and career resources, which encompass award-winning workforce development, relevant content, groundbreaking industry standards and a diverse community of professionals who are driven to create a better world through supply chain.

Acknowledgments

ASCM would like to extend our gratitude to the following subject matter experts for their voluntary contributions, time commitment, expertise, and passion to the continued development of the CTSC program.

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We would also like to thank the ASCM Corporate Members for their support in the advancement and education of supply chain and operations management.

ASCM relies on the support of volunteers to maintain the quality and prestige of the APICS certification programs.

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Letter to Candidates

Dear Candidate:

On behalf of ASCM and the members of the Certified in Transformation for Supply Chain (CTSC) Exam Subcommittee, I want to thank you for your interest in the APICS CTSC program. ASCM is the global leader and premier source of the body of knowledge in operations management, including production, inventory, supply chain, purchasing, and logistics. Since 1957, individuals and companies have relied on ASCM for its superior training, internationally recognized certifications, comprehensive resources, and worldwide network of accomplished industry professionals.

Over the last decade, global supply chains have witnessed significant disruptions triggered by environmental, macro-economic, and technological shifts as well as major geopolitical conflicts. These paradigm-altering events have become more frequent and wide-ranging. As a result, supply chain leaders across every industry and their extended enterprise, including the web of suppliers, manufacturers, distributors, retailers, and transportation carriers involved in bringing products to markets, are realizing the need to be prepared for future crises and be ever-ready to realign their businesses to better serve customers in this disruptive world. Surviving and thriving in this context requires supply chains to continually challenge the status quo and transform their culture, question their business models, reimagine and redesign their networks, build and execute a sustainable, extended and integrated supply chain strategy with very little margin of error. To be successful in this contextual reality, supply chain professionals need to become transformational leaders who are system thinkers; digitally fluent; able to seamlessly connect physical, digital, and human worlds; and adept at using new generations of tools, data sources, and

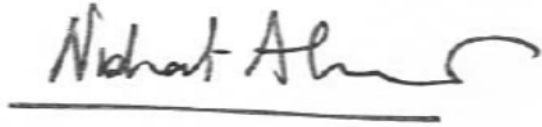
analytical methods geared to the challenges of the new norm in all types of supply chain – forward, reverse, and circular.

The CTSC program is primarily intended for professionals engaged in supply chain transformation. It is designed to test the candidate's knowledge of and ability to apply the supply chain transformation body of knowledge to evolve, adapt, and transform their supply chains. By earning the CTSC credential, candidates have demonstrated mastery of supply chain transformation frameworks and best practices. In addition, they have distinguished themselves as having specialized, high-level knowledge and skills in systems thinking; end-to-end strategic supply chain architecting, planning, and deployment; leadership; governance and project portfolio management; monitoring, measurement, and analysis; risk and resilience management; change management; digital transformation; and continuous improvement. The CTSC program will help you advance your career while giving you validated foundational knowledge to assist in aligning your supply chain from cost to value focus and from a silo to an interdisciplinary mode of operations with an ultimate goal of improving your company's competitive position and profitability.

In 2022, ASCM conducted a logical job task analysis (JTA) involving practicing supply chain professionals across many industry types. The CTSC Exam Subcommittee carefully analyzed the JTA results and used them to craft the exam content outline. This current exam content manual (ECM) represents the result of that extensive and comprehensive work. This ECM provides you with an overview of the program, an outline of its body of knowledge, key terminology, and references. The outline is divided into four diagnostic areas, and the relative emphasis of each of the areas is indicated by a percentage figure. A sample of exam questions is also provided, which demonstrates the type of questions you will encounter on the exam. The exam content manual should not be the only reference you

use to prepare for the CTSC exam; however, it should be the first.

We wish you success in your pursuit of the CTSC designation.

A handwritten signature in black ink, reading "Nishat Ahmed", is positioned above a solid horizontal line.

Nishat Ahmed, PE, CPIM, CIRM, CSCP, CPM,
CLTD, SCOR-P, CTL
CTSC Exam Subcommittee Chair

Introduction

This exam content manual (ECM) provides guidance for individuals preparing for the CTSC certification examination. The objective of this manual is to outline the APICS CTSC body of knowledge.

The CTSC body of knowledge section of this manual begins with a statement on 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 exam overview concludes with sample questions similar to those that appear on the examination along with the 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, and
- study each topic area using the suggested references.

At the end of each major section of the content outline 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 chapter(s) within that reference.

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

Sufficient references are given for each topic area that provides different approaches to material covered in each exam and different styles of presenting it. Reading periodicals including SCM Now Impact, the ASCM Insights blog, and ASCM research reports, as well as listening to podcasts, such as ASCM's The Rebound, will help you keep up to date about industry trends.

About the APICS CTSC Examination

The APICS CTSC exam consists of 150 questions, of which 20 are pre-test questions that do not contribute to the total score but are used for statistical purposes only. Pre-test questions are continuously introduced and evaluated statistically, as part of an industry best practice for certification program exam development. Pre-test questions appear similar to the scored questions and are randomly distributed throughout the exam. Candidates should answer all exam questions. There is a 3 ½ hour time limit for the exam.

For more information regarding testing and registration policies and procedures, please visit ascm.org/CTSC and the [APICS Exam Handbook and Testing Policies](#).

Question Format

The questions on the CTSC exam are intended to test a candidate's understanding of the CTSC body of knowledge. The questions frequently require the candidate to select the best of four choices or complete a calculation based on the information given. They may also ask the candidate to illustrate their understanding of a concept, process, or procedure. These questions may require the examinee to make finer or more in-depth distinctions than the exercises or items presented in a course. It is helpful to understand the various formats of questions on the examination. Practice questions can be found in the Sample Questions section of this ECM.

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 CTSC body of knowledge as represented by the exam content manual.

When you begin the 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 a table or graph, be sure to study it before answering the question. Avoid assuming that information is not provided, assuming that 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 also been taken to avoid misleading choices. Do not look for hidden tricks or exceptions to the norm. For each multiple-choice question, one and only one of the answer 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 later to the ones that are difficult for you. 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 that 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 CTSC exam scaled score range is 200 – 350.

200–299: Fail

300–350: Pass

The minimum passing score is 300. Candidates will receive a final exam score

along with diagnostic information by topic area on their performance. All APICS exams use this 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](#).

Studying for the APICS CTSC Exam

APICS offers several resources to help individuals prepare for the APICS CTSC exam.

APICS CTSC References

CTSC Content Outline. The CTSC content outline provided in this ECM 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 relevant to that topic.

Bibliography. The APICS CTSC Exam Subcommittee have validated a number of references for the APICS CTSC exam. These references are used by both the exam subcommittee and the CTSC Courseware Subcommittee in the development of exam questions and preparation materials. These are listed in the Bibliography section of this manual. All of the references contain excellent material that will assist in understanding the body of knowledge and preparing for the test. For additional information on the APICS CTSC references, visit the [CTSC Exam References](#) page.

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 most accessible and understandable.

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

ASCM Supply Chain Dictionary. The [*ASCM Supply Chain 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 exam uses standard terminology as defined in the *ASCM Supply Chain Dictionary*. Recognizing the terms and understanding their definitions are essential.

Terminology

In studying for the APICS CTSC certification exam, candidates may discover multiple terms used to denote the same technique. Examples of this include “business process reengineering (BPR)” versus “radical change” and “digital twin” versus “virtual twin.” ASCM and the certification exam subcommittees have worked 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 Content Outline and Key Terminology sections of this manual, using the *ASCM Supply Chain Dictionary* as the primary guide for definitions.

Additional Resources for APICS CTSC Candidates

In addition to the cited references, it may be helpful for you to pursue chapter-sponsored courses, college courses, ASCM workshops, self-study courses, or courses offered by the ASCM 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 various learning options before choosing one.

APICS CTSC Learning System

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

The APICS CTSC Learning System does not “teach the tests.” The APICS Learning Systems provide a thorough review of the subject matter, but they should not be used without the most current APICS Exam Content Manual (ECM) as a means to direct the candidates to study. There will likely be some content in the APICS CTSC Learning System not covered by the exam; conversely, there will likely be some content in the exam not covered by the learning system. No CTSC exam questions are derived from the learning system. Thus, it is essential for candidates to use the current ECM in their studies.

APICS CTSC Instructor-Led Review Courses and Educational Programs

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

ASCM also offers a variety of educational programs. For a complete list of learning opportunities and resources, please visit ascm.org.

Job Task Analysis

The subject matter in the inaugural CTSC exam content outline was created and validated by means of a logical job task analysis (JTA) study. During a logical JTA, industry professionals are consulted to determine which tasks within a specific role are most important. JTAs 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.

The JTA process is vital to all high-stakes certifications as it establishes the body of knowledge for new exam programs, as well as validates the existing body of knowledge and identifies new topic areas and content that is at the cutting edge of the industry to update existing exam programs. In following testing industry standards and best practices, ASCM regularly conducts a JTA for each of its certifications. For the inaugural CTSC program, this process involved bringing together a task force of industry-specific professionals that represent a diverse skill set in supply chain transformation frameworks, transformation and change management, systems thinking, optimization theory, risk and resilience management, audits, assessments and benchmarking and continuous process improvement. These professionals, under the guidance of a third-party JTA facilitator, worked to identify the knowledge, skills, and tasks deemed important in the practice of supply chain transformation and continuous improvement. The JTA results were then analyzed, resulting in a recommendation of key concepts and topic areas to the CTSC Exam Subcommittee for the establishment of its inaugural content outline.

Exam Content versus Courseware

Certification has a very different purpose than education. It is to determine whether a candidate meets a minimum set of requirements in relation to a body of knowledge. Certification exams 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 or complete a calculation based on the information given. They may also 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.

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

APICS exam subcommittees 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 subcommittees also validate the references that will be used for exam development. Additionally, the exam subcommittees work with ASCM staff in the creation and maintenance of exam forms.

A separate courseware subcommittee – in conjunction with a courseware task force, ASCM staff, and a third-party vendor – create the learning systems using the ECM and recommended references.

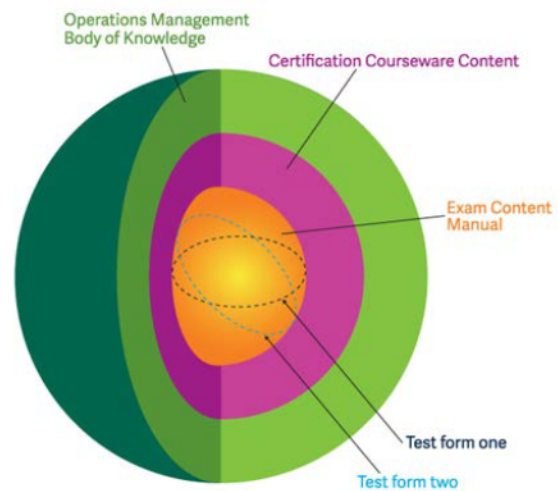
Courseware developers and/or instructors may believe that additional material needs to be taught or included to ensure understanding of the body of knowledge. They also may decide that a concept or term is adequately covered by the definitions in the *ASCM Supply Chain Dictionary* or content outlines and not cover it in the course. These differences sometimes lead candidates to perceive a disconnect between the courseware and the exam when, in fact, they are both covering the same body of knowledge.

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

A potential test question will be reviewed multiple times before it actually appears on an exam. 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 exam and count towards a test-taker's exam score and result.

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 representative of the relationship between the Operations Management Body of Knowledge (OMBOK), courseware / learning systems, ECMs, and different exam forms.



APICS CTSC Certification Maintenance: Continuing Professional Development

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

CTSC-certified individuals are required to collect 75 certification maintenance points in these five-year intervals to keep their certification active for an additional five years. If they do not submit their maintenance points via the APICS certification maintenance application by the maintenance due date, their certification will be placed into suspended status. The individual will then have 90 days to submit their maintenance application. If an individual does not maintain their CTSC certification, they will lose their certification and will be required to retake and pass the exam again.

The Importance of Certification Maintenance

Maintaining your APICS CTSC certification demonstrates one's commitment to achieving the highest level of professional development and standards of excellence.

The APICS CTSC certification maintenance program upholds both the objectives of the APICS CTSC program and the ASCM 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 credentials,
- expanding your knowledge of the latest industry practices,
- exploring new technology solutions,
- reinforcing skills,
- improving job performance,
- demonstrating commitment to excellence, and
- increasing competitive advantage.

To ensure that CTSC-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 CTSC designation, please visit [ascm.org/maintenance](https://www.ascm.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 APICS CTSC 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;
- Do 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; APICS conference presentations; and CPIM, CSCP, CLTD, CTSC, 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, do 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
- Do not become the subject of public disrepute, contempt, or scandal that affects your image or goodwill.

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

Bibliography and References for CTSC

All test candidates should familiarize themselves with the following references for the CTSC exam. The recommended references pertaining to the content area are listed at the end of each section of the content outline. The references listed below can also be found online on the [CTSC Exam References](#) page. A complimentary digital copy of the *ASCM Supply Chain Dictionary* is available to ASCM members on the online [ASCM Member Benefits](#) page. It can also be accessed on the Courses & Downloads section of members' [My Account page](#).

	References	Author(s)
1	<i>ASCM Digital Capabilities Model (DCM) for Supply Networks Version 1.0</i>	ASCM
2	<i>ASCM Enterprise Standards for Sustainability Version 1.2</i>	ASCM
3	<i>ASCM Supply Chain Dictionary, 17th ed., 2022</i>	ASCM
4	<i>ASCM Supply Chain Operations Reference Model: SCOR Digital Standard (SCOR DS) Version 14.0</i>	ASCM
5	<i>Digital Supply Chain Leadership: Reshaping Talent and Organizations, 2022</i>	Kurz, David B., and Murugan Anandarajan
6	<i>Digital Transformation of the Supply Chain: A Practical Guide for Executives, 2021</i>	Tan, Albert, and Sameer Shukla
7	<i>Principles of Supply Chain Management, 2nd ed., 2014</i>	Crandall, Richard E., William R. Crandall, and Charlie C. Chen
8	<i>Strategic Supply Chain Management: The Five Core Disciplines for Top Performance, 2nd ed., 2013</i>	Cohen, Shoshanah, and Joseph Roussel
9	<i>Supply Chain Analytics: Using Data to Optimise Supply Chain Processes, 2020</i>	Robertson, Peter W.
10	<i>Supply Chain Excellence: A Handbook for Dramatic Improvement Using the SCOR Model, 3rd ed., 2011</i>	Bolstorff, Peter, and Robert Rosenbaum
11	<i>Supply Chain Leadership: Developing a People-Centric Approach to Effective Supply Chain Management, 2022</i>	Robertson, Peter W.
12	<i>Supply Chain Risk Management: How to Design and Manage Resilient Supply Chains, 3rd ed., 2020</i>	Manners-Bell, John
13	<i>Supply Chain Transformation: Building and Executing an Integrated Supply Chain Strategy, 2012</i>	Dittmann, J. Paul
14	<i>Transforming Supply Chains, 2019</i>	Gattorna, John, and Deborah Ellis

Note: At the end of each major section in the CTSC content outline is a list of the references that apply to the topics within that section. The first number indicates the sequence number for the references designated in each subject area within the content outline. For example, "7 (chapters 4, 8, 11, 14, 16)" refers to the reference, *Principles of Supply Chain Management, 2nd ed., 2014*, and chapters 4, 8, 11, 14, and 16 of that reference contain content relevant to that subject matter.

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Scope of the Subject Matter

Please read the introductory material in this manual for essential information pertaining to the exam.

APICS CTSC covers concepts, frameworks, strategies, processes, tools, and technologies applied to managing the end-to-end supply chain transformation in the flow of materials, information, and value in a supply chain.

The subject matter is organized into four supply chain transformation knowledge areas, stages, and phases: Supply Chain Transformation Overview, Preparing for Supply Chain Transformation, Executing Supply Chain Transformation, and Review of Supply Chain Transformation.

Supply Chain Transformation Overview. This section sets the stage for undertaking supply chain transformation by clarifying traditional and emerging terms and definitions in the supply chain arena. Various supply chain transformation frameworks including the ASCM SCOR Digital Standard (SCOR DS), ASCM Digital Capabilities Model (DCM) for Supply Networks, Lean, and Six Sigma are presented, and these frameworks can be used to evolve,

adapt, and align the supply chains to changing context. Governance documents, various business performance measures – including balanced scorecard and key performance indicators (KPIs) – and financial metrics that support the transformation success, such as revenue growth, market share, margin, and break-even time performance, are discussed. Skills, roles, and responsibilities of leaders – such as deploying supply chain transformation initiatives; managing change; utilizing knowledge of personnel and organizational dynamics; aligning culture; using appropriate intervention, communication, and influencing mechanisms; and addressing project roadblocks that are critical to successful supply chain transformation – are presented. Utility of context-determining tools – such as SWOT, PESTLE, contingency planning, business continuity, and risk and resilience management – to enhance strategic planning and deployment of supply chain transformation efforts is also discussed.

Preparing for Supply Chain Transformation.

This section contextualizes supply chain transformation effort by determining external and internal issues that are relevant to an organization and its supply chain purpose and that affect its ability to achieve the intended outcome(s) of its supply chain. Interested parties are identified and their needs and expectations – including legal, regulatory, environmental, technological – are defined, understood, and serve as guiding signals for supply chain transformation. Infrastructure for overseeing transformation projects across all phases of project management life cycle – including initiation, planning, execution, control, and closure – is established to evaluate the initiatives in terms of their scope, goals, time, cost, quality, human resources requirements, communication needs, and risks. Designing, supporting, and reviewing the development of an overall measurement methodology to record the progress and ongoing status of supply chain transformation projects and their overall impact on the organization is discussed. Also included in this section are assessing the current level of knowledge and skills in relation to skills and

abilities that are needed for transformation and consequently determining the training requirements by using tools, such as a gap analysis and benchmarking, to compare actual performance with potential or desired performance.

Executing Supply Chain Transformation. This section focuses on applying systems thinking and a variety of creativity and innovation tools (including prototyping, modeling and simulation, and augmented reality) to develop, analyze, verify, and validate concept alternatives for transformation in terms of functional and performance requirements, information derived from previous transformation efforts, statutory and regulatory requirements, standards, codes of practice, or framework best practices that organization has committed to implement and potential consequences of failure due to the nature of product and services. It also discusses concepts related to managing change and utilizing techniques including rewards, recognition, team competitiveness, and communication of transformation effort to effect a successful transformation.

Review of Supply Chain Transformation. This section focuses on evaluating the supply chain transformation planning and execution by monitoring, measuring, analyzing, and evaluating the performance against established baselines. Audits, assessments, and certifications are undertaken to validate the maturity of the transformation effort, and lessons learned are incorporated into next phase or stage of transformation to continually improve the suitability, adequacy, and effectiveness of the supply chain transformation.

The successful candidate will be able to recognize the strategic imperative of supply chain transformation, identify risks and opportunities, and select the appropriate philosophies, frameworks, models, and approaches to effect transformation. The candidate will be able to define the actions necessary to implement selected solutions.

This includes an understanding of and the ability to manage:

- the alignment of supply chain processes and capabilities with strategic transformation goals.
- skills, roles, responsibilities, and infrastructure need for successful supply chain transformation.
- the selection and use of appropriate tools and technologies to enable effective supply chain transformation.
- lessons learned and realization of benefits from all phases of a transformation project and identification of strategies for reinforcing and replicating improvements.

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

- Strategic Planning
- Leadership
- Project Management
- Accounting and Finance
- Modeling and Simulation
- Change Management
- Optimization
- Continuous Process Improvement
- Digital Transformation

Exam Percentage by Content Area

The following table identifies the four main content areas of the exam. The relative importance of these topics varies among industries, but the figures show the percentage designated for each section on the exam.

Main Content Area	Percentage of Exam
I. Supply Chain Transformation Overview	33%
II. Preparing for Supply Chain Transformation	41%
III. Executing Supply Chain Transformation	15%
IV. Review of Supply Chain Transformation	11%

Content Outline

The content outline provides an overview of the major content areas assessed on the CTSC exam. Each of the four main content areas is denoted by a Roman numeral.

I. Supply Chain Transformation Overview

This section encompasses the fundamentals of supply chain transformation, from knowledge of frameworks, benchmarking tools, and optimization roadmaps to an understanding of security and risk management considerations and key organizational drivers. Supply Chain Transformation Overview also includes skills, roles, and responsibilities required of transformation leaders.

A. Supply Chain Transformation Introduction

1. Define and Classify the Types of Supply Chains
2. Learn the Supply Chain Maturity Stages
3. Explore Business Cases for Transformation

B. Supply Chain Transformation Strategy Overview

1. Understand Organizational Supply Chain Strategies
 - a. Market types
 - b. Strategy types
 - c. Supply chain strategic components (examples include goals, key performance indicators (KPIs), action plans, and strategy maps)
2. Comprehend Organizational Value Proposition
 - a. Suppliers
 - b. Service providers
 - c. Product and service operations
 - d. Intermediaries
 - e. Customers
 - f. Supply chain network
3. Research Models, Frameworks, and Benchmarking Tools
 - a. Balanced scorecard
 - b. ASCM SCOR Digital Standard (SCOR DS) and SCORmark
 - c. Global Reporting Initiative (GRI)

- d. ASCM Enterprise Standards for Sustainability
 - e. ISO standards
 - f. ASCM Digital Capabilities Model (DCM) for Supply Networks
 - g. Capabilities Maturity Model Integration (CMMI)
 - h. American Productivity & Quality Center (APQC) supply chain planning benchmark
4. Explore Cost and Service Optimization Roadmaps
 - a. Lean
 - b. Six sigma
 - c. Theory of constraints (TOC)
 - d. Total quality management (TQM)
 - e. Agile operations
 - f. Project management
 5. Understand Organizational Design
 - a. Organizational types and size
 - b. Organization structure and hierarchy
 - c. Talent assessment and alignment
 - d. Collaboration mechanisms
 - e. Performance management models
 6. Understand Risk Management Methodology
 - a. Risk context
 - b. Risk management framework
 - c. Risk identification, analysis, and evaluation
 - d. Risk treatment options
 7. Understand Supply Chain Security Landscape
 - a. Information security
 - b. Cybersecurity
 - c. Physical security
 - d. Counterfeits

C. The Drivers of Supply Chain Transformation

1. Recognize the Internal and External Organizational Context
 - a. Tools and models for understanding context
 - b. Market and customer segmentation
 - c. Culture and capabilities
 - d. Technologies
2. Discuss Benchmarking and Relative Performances

- a. Customer satisfaction and retention
- b. Efficiency and effectiveness
- c. Supply chain costs
- d. Growth
- 3. Outline Environmental, Social, and Governance (ESG) and Corporate Social Responsibility (CSR) Requirements

D. Supply Chain Transformation Leadership and Culture

- 1. Identify Supply Chain Transformation Leadership Skills
- 2. Understand Organizational Culture to Enable Transformation Efforts

References: 1; 2; 3; 4; 5 (chapters 1, 5-7); 6 (chapters 1, 2); 7 (chapters 1-5, 7-13, 17, 18); 8 (chapters 1, 3); 9 (chapters 1, 2, 4); 10 (chapters 1, 3, 18); 11 (chapters 1, 2); 12 (chapters 1, 2, 13); 13 (chapters 1, 7); 14 (chapters 1, 2, 7)

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. Preparing for Supply Chain Transformation

This section includes important tasks that must be completed prior to implementing a supply chain transformation. This includes selecting drivers and KPIs, performing gap analysis to identify the current and future supply chain states, and initiating projects and engaging stakeholders. Stakeholder needs are established and serve as guiding signals for supply chain transformation, and portfolio governance and project prioritization are initiated.

A. Select Supply Chain Transformation Drivers

- 1. Macroeconomics
- 2. Legal and Regulatory Landscape
- 3. Geopolitical

- 4. Industry and Market Characteristics
- 5. Voice of the Customer (VOC) and Voice of the Process (VOP)
- 6. Strategic Imperatives
- 7. Sustainability
- 8. Digitization
- 9. Process and Performance Metrics Benchmark

B. Assess Supply Chain Current State

- 1. Perform Gap Assessments
- 2. Conduct Maturity Assessments
- 3. Identify Common Misalignments

C. Conceptualize the Future State Supply Chain Operation Model

- 1. Perform Process and Geographic Mapping
- 2. Develop Modeling and Simulations
- 3. Analyze Alternatives
- 4. Refine the Target Value and Benefits

D. Identify Initiatives to Address Gaps

- 1. Identify Transformation Initiatives
- 2. Scope Using Data and Strategic Assessment
- 3. Prioritize Initiatives
- 4. Define To-Be State Metrics to Analyze As-Is Performance in Detail

E. Initiate Transformation Workstreams and Projects

- 1. Create Project Charters
- 2. Set Transformation Program Kickoff and Milestones
- 3. Develop Resource Management Plan(s)
- 4. Document Communication Plan(s)
- 5. Document Change Management Plan(s)
- 6. Create Stakeholder Management Plan(s)

F. Develop and Iterate Transformation Preliminary Business Case(s)

- 1. Set Targeted Value Drivers

2. Quantify Financial Value of Supply Chain Improvements
3. Determine Resources Needed
4. Estimate Cost and Schedule
5. Select KPIs
6. Craft Messaging Content

G. Select Supply Chain Transformation Framework(s)

H. Develop Supply Chain Transformation Roadmap(s)

1. Assemble Project Portfolio
2. Validate Costs, Schedules, Resources, and KPIs

I. Develop Supply Chain Transformation Detailed Business Case(s)

1. Specify Supply Chain Value Drivers
2. Assess Financial Value of Supply Chain Improvements
3. Conduct Analysis of Alternatives

J. Draft Execution Plan(s)

K. Establish and Align Portfolio Governance

1. Define Portfolio
2. Prioritize the Projects
3. Determine Target Value and Benefits
4. Establish Oversight Mechanisms and Frequencies

References: 1; 2; 3; 4; 5 (chapters 2-5, 9); 6 (chapters 3-6); 7 (chapters 1-5, 7-18); 8 (chapters 2-6); 9 (chapters 1, 3, 4); 10 (chapters 2, 4-6, 8-11, 19); 11 (chapters 2-5, 8); 12 (chapters 1-14); 13 (chapters 1-6); 14 (chapters 3-10)

III. Executing Supply Chain Transformation

To implement the transformation effort, transformation leaders need to apply systems thinking and a variety of tools to develop, analyze, verify, and validate concept alternatives for transformation. Training needs are assessed and addressed, incentives are

identified, and governance and risk management frameworks are implemented.

A. Adopt a Change Management Plan

1. Tailor Change Management Process
2. Assign Roles and Responsibilities
 - a. Change control board (CCB)
 - b. Change sponsor
 - c. Change agents and champions
3. Confirm Process and Channels of Communication
 - a. Internal communication
 - b. External communication
4. Provide Training
 - a. Development of tailored job descriptions
 - b. Training needs assessment
 - c. Implementation of training program
 - d. Pre- and post-training program evaluation
5. Identify and Implement Incentives
 - a. Intrinsic motivators
 - b. Extrinsic motivators

B. Design and Implement Supply Chain Transformation Workstreams and Projects

1. Collaborate with Internal and External Stakeholders
2. Design and Test Solutions
 - a. Supply chain architecture
 - b. Mock-up and prototyping process and flow
 - c. Network modeling and simulations
 - d. Pilot project execution
3. Implement Project KPIs
4. Implement Individual Projects
5. Scale-Up to Enterprise-Wide Solutions

C. Implement Governance and Risk Management Framework

1. Set Portfolio and Project Management Governance
2. Implement Portfolio and Project Risk Management
3. Institute Supply Chain Information Security
4. Establish Resilient Supply Chain Benchmarks

5. Obtain ASCM Enterprise Certification for Sustainability

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

IV. Review of Supply Chain Transformation

Upon completion of transformation projects, careful assessments of the planning, designing, and execution phases of the project are necessary to validate the maturity of the supply chain transformation. Lessons learned are incorporated into the next phase or stage of transformation to continually improve the suitability, adequacy, and effectiveness of the supply chain transformation.

A. Assess the Transformation

1. Review and Provide Feedback on Project Portfolio Performance
 - a. Critical success factors and KPIs
 - b. Tracking mechanisms
2. Assess Supply Chain Transformation Maturity
 - a. Maturity rating
 - b. Assessment and audit results

B. Communicate Results with Internal and External Stakeholders

C. Reflect on the Transformation

1. Gather Feedback
2. Document Lessons Learned
3. Implement Continual Improvement
4. Identify Future Initiatives

References: 1; 2; 3; 4; 5 (chapters 8, 10); 7 (chapter 16); 8 (chapters 6, 7); 9 (chapters 7, 8); 10 (chapters 4-6, 19); 11 (chapters 3, 8); 14 (chapters 5, 8, 10, 11)

Key Terminology

An understanding of the following list of key 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 *ASCM Supply Chain Dictionary, 17th edition*. Definitions for those terms followed by an asterisk (*) below are included in the Supplemental Glossary listed below the key terms.

In studying for the APICS CTSC certification, candidates may discover multiple terms used to denote the same technique. Examples of this include “business process reengineering (BPR)” versus “radical change” and “digital twin” versus “virtual twin.” ASCM and the certification exam subcommittees have attempted to provide consistency across all exams with recognized and preferred terminology. However, synonyms are often used by authors in the various references used to compile the body of knowledge.

CTSC Key Terminology

actual costs
budget
budget at completion (BAC)
business process management (BPM)
business process reengineering (BPR)
cause-and-effect diagram
circular supply chain*
competitive benchmarking
cost management
cost performance index (CPI)
data acquisition
digital contract management
digital supply chain
digital supply network*
digital twin
earned value
earned value method
enterprise performance management (EPM)
environmental scanning
estimate at completion (EAC)
failure mode and effects analysis (FMEA)
fault tree analysis
five whys
five-forces model of competition
flow process chart

forward supply chain*
integrated business planning
knowledge management
maintenance, repair, and operating (MRO) supplies supply chains*
maintenance, repair, and overhaul (MRO) supply chains*
manufacturing execution system (MES)
master data management (MDM)
network design
new product supply chains*
PESTLE analysis
plan-do-check-action (PDCA)
planned value
process benchmarking
product benchmarking
product life cycle
program management
project life cycle
project management team
project plan
project portfolio management (PPfM)*
RACI (responsible, accountable, consulted, and informed) analysis
responsibility assignment matrix (RAM)
responsive demand-supply matching (RDSM)

reverse supply chain
risk transfer*
root cause analysis
sales and operations planning (S&OP)
schedule performance index (SPI)
service industry supply chains*
smart operations
stakeholder relationship management
strategic benchmarking
supplier-input-process-output-customer (SIPOC) diagram

supply chain control towers
SWOT analysis
systems thinking
systems view
throughput accounting
transportation management system (TMS)
triple bottom line (TBL)
United Nations (UN) Global Compact
value chain
warehouse management system (WMS)

Supplemental Glossary

The following key terms are not found in the *ASCM Supply Chain Dictionary, 17th edition*, so definitions have been provided below.

Circular supply chain – A type of supply chain that involves the reuse, recycling, refurbishment, and repurposing of used products and/or materials to allow companies to maximize their investment in materials and labor, extend the product life cycle, and reduce their carbon footprint. Circular supply chain is the opposite of a linear supply chain, which creates products from original materials and discards material byproducts and products at the end of their life cycles.

Digital supply network – Digital supply networks integrate physical and digital channels to establish digital records, facilitate the continuous flow of information, and generate advanced data & analytics for informed supply chain decision-making. The interconnectedness of physical and digital channels allows for the creation of digital records from physical data (physical-to-digital), the increased availability and volume of digital records to make more informed actions in the physical world (digital-to-physical), and the utilization of the latest technology and advanced analytics, such as artificial intelligence (AI) and machine learning, to glean richer insights (digital-to-digital).

Forward supply chain – A type of supply chain whose primary components include material suppliers, production facilities, distribution services, and customers that are linked together by the feed-forward flow of materials and feedback flow of information.

Maintenance, repair, and operating (MRO) supplies supply chain – The acquisition, production, and delivery of items used in support of general operations and maintenance to the point of consumption.

Maintenance, repair, and overhaul (MRO) supply chain – The acquisition, production, and delivery of items used for reprocessing in

the remanufacturing industry to the point of consumption.

New product supply chains – Supply chains that create strategic value by launching new products. With focus on speed and responsiveness, new product supply chains are highly collaborative, require more capacity and flexibility, and are less efficient, with unpredictable demand. Launch may require new production methods, sourcing strategies, suppliers, manufacturers, distributor networks, and trading partners.

Project portfolio management (PPfM) – A process in which an organization's projects are evaluated to ensure strategic alignment with the company's goals. To achieve companywide objectives, project managers and executives must understand the benefits, best practices, and software of project portfolio management.

Risk transfer – A form of risk treatment involving the agreed distribution of risk with other parties. The extent to which risk is distributed can depend on the reliability and clarity of the sharing arrangements. Risk could be transferred through insurance or other forms of contract.

Service industry supply chains – A supply network that transfers resources into services or servitized products, with or without physical products, to satisfy customer needs.

Sample Questions

The following six questions are similar in format and content to the questions on the exam. These questions are intended for practice and to illustrate the way questions are structured. 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 response with the explanation on page 21.

1. Which of the following optimization approaches would an organization most likely adopt if customer demand is uncertain and customers expect prompt delivery?
 - (A) Lean
 - (B) Agile operations
 - (C) Six sigma
 - (D) Total quality management (TQM)
2. Which of the following approaches would an organization adopt to develop a supply chain strategy that balances competing priorities of customer satisfaction, cost, and working capital?
 - (A) Start with its suppliers' capabilities and move forward.
 - (B) Start with its customer needs and work backward.
 - (C) Start with its customer needs and work forward.
 - (D) Start with its suppliers' capabilities and move backward.
3. Which of the following types of supply chain models reflects the practice of reusing an item either for its original purpose or to fulfill a different function?
 - (A) Extended
 - (B) Integrated
 - (C) Linear
 - (D) Circular
4. Which of the following metrics is considered a customer-facing key performance indicator (KPI)?
 - (A) Cost of goods sold (COGS)
 - (B) Cash-to-cash cycle time
 - (C) On-time delivery to request
 - (D) Inventory days of supply
5. A company is monitoring and assessing risks 24 hours a day, 7 days a week through supply chain crisis management teams located in key regions, which gives the company increased ability to address disruptions rapidly. This is an example of a:
 - (A) responsive supply chain.
 - (B) resilient supply chain.
 - (C) flexible supply chain.
 - (D) continuous supply chain.
6. A company is assessing its supply chain transformation results against targeted key performance indicators (KPIs) and wants to track whether the change is taking root. Which of the following tools is best to do this assessment?
 - (A) Balanced scorecard
 - (B) Business constraint analysis
 - (C) Hoshin planning
 - (D) Value stream mapping

Answers to Sample Questions

Note: References to the content outline appear in parentheses.

1. B (I.B.4) The agile methodology is best for customers who expect fast, flexible delivery under uncertain market conditions, as it reflects that the organization is able to create and respond to change. It is a way of dealing with and succeeding in an uncertain and turbulent environment. Lean is a way of creating needed value with fewer resources and less waste, and it focuses on meeting customer expectations for reliable and low-cost service. Six sigma uses a data-driven management process to optimize and improve business processes. The underlying framework is a strong customer focus and robust use of data and statistics to conclude. Total quality management (TQM) consists of organization-wide efforts to establish and maintain a climate where employees continuously improve their ability to provide on-demand products and services that customers will find of particular value.
2. B (I.B.1) Option B concentrates the supply chain strategy on responding to the needs of the customers and determining how best to satisfy those needs all the way back to the vendor base. Option A focuses on determining supply chain best practices and developing a strategy to employ best practices appropriately from the vendor base to the firm and finally out to the customer, which will likely result in failing to meet the customer requirements or overengineering to meet generalized best practices. Options C and D do not represent meaningful representations of supply chain strategy development.
3. D (II.A.7) A circular supply chain reuses, shares, repairs, refurbishes, recycles, and upcycles, resulting in decreased material costs and increased sustainability. In an extended supply chain, at least one business process is extended beyond the boundary of the individual corporation. Linear supply chain uses a process of manufacturing, using, and discarding stages, and nothing is reused or repurposed. Integrated supply chain is when all suppliers in the value chain are working collaboratively and have access to each other's systems and processes.
4. C (III.B.3) All options are examples of supply chain KPIs, but only option C (on-time delivery to request) is a customer-facing KPI. The other options are internal-facing metrics.
5. B (III.C.4) A resilient supply chain is one that can be restored quickly to its original state and preferably maintain output at a steady rate shortly after a disruptive event. Option A (responsive supply chain) refers only to the speed of responding to marketplace changes. Option C (flexible supply chain) refers to the supply chain's ability to change its output according to the market. Option D (continuous supply chain) is about establishing a pull for replenishment.
6. A (IV.A.2) Balanced scorecard is the best tool to achieve this company's transformation assessment goals, as it uses targeted KPIs as a means of assessing ongoing supply chain maturity and is broader in scope by looking at the organizational tradeoffs. Business constraint analysis is narrower in scope and focused on identification of bottlenecks and constraints for group performance. Hoshin planning is focused on breakthrough planning and strategy. Value stream mapping is a process improvement tool.

Thank you for your interest in the APICS CTSC certification program. For any questions regarding the content found in this Exam Content Manual, please contact ASCM customer relations at 1-800-444-2742 or 1-773-867-1777 or support@ascm.org.

ABOUT ASCM

The Association for Supply Chain Management (ASCM) is the global pacesetter of organizational transformation, talent development and supply chain innovation. As the largest association for supply chain, ASCM members and worldwide alliances fuel innovation and inspire accountability for resilient, dynamic and sustainable operations. ASCM is built on a foundation of world-class APICS education, certification and career resources, which encompass award-winning workforce development, relevant content, groundbreaking industry standards and a diverse community of professionals who are driven to create a better world through supply chain.

