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# Creating a Valid and Reliable CMA Exam

Have you ever wondered how the CMA® exam comes to life? It's a long, intricate process that emphasizes accuracy, completeness, and teamwork.

**C**reating a valid and reliable professional certification exam is a multistage process that begins with a clear identification of the profession to be tested and ends with the issuance of the certification. In this article we focus on three aspects of that process: (1) the creation of the CMA (Certified Management Accountant) exam Content Specification Outline (CSO), (2) the development of exam questions, and (3) the procedure by which we set the passing standard.

The concepts of validity and reliability are important ones and warrant further explanation. Validity refers to the appropriateness, meaningfulness, and usefulness of an exam score. A valid professional examination is one that assesses competence in the relevant skills of the profession. For the CMA exam, that means we must identify the knowledge that's necessary for someone to competently perform the tasks of accountants and financial professionals in business. A reliable exam is an exam that consistently predicts the competence, or lack of competence, of the indi-

vidual taking the exam. A reliable exam is one that yields consistent results—i.e., individuals taking the exam will earn the same approximate score on multiple exam sittings, assuming the candidate's knowledge level hasn't changed. The CMA exam is a valid and reliable exam, one that supports the confidence we have that a CMA is competent in the skills most needed on accounting and finance teams today.

## Creating the Content Specification Outline

Validity begins with a psychometrically sound job analysis study. The CMA job analysis study surveys management accounting and finance professionals around the world to identify the tasks that they perform on a daily basis and the knowledge they need to perform those tasks effectively. This study also identifies the skills that will help these professionals reach the next higher level within their profession. For this reason, aspirational-type knowledge and skills are tested as well. A professional certification exam, however, doesn't test brand-new techniques that haven't become accepted practice.

In addition to the job analysis study, we also conduct a literature

review in which we study research from other independent bodies on the accounting skills most in demand. This process ensures that the CMA exam measures what it is intended to measure: the most relevant skills and knowledge required of management accounting and finance professionals in business.

A team of subject matter experts (SMEs), including the Board of Regents of the ICMA® (Institute of Certified Management Accountants), uses the results of the job analysis study and other relevant research to develop the CSO. This CSO serves as the guide for development of exam questions as well as the appropriate number of questions from each content domain. A content domain is a major subject area, such as Planning and Budgeting or Cost Management. The Regents also develop an exam blueprint that specifies the number of questions at different cognitive levels. We use Bloom's Taxonomy as the structure to classify the cognitive levels of questions as Level A, B, or C. Level A is the most basic level and requires recall of facts and recognition of principles. Level A questions include the skill levels of knowledge and comprehension. Level B includes ques-



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tions that test for the application of material to novel situations and the ability to analyze information into its component parts. Level C is considered the “highest” or most challenging level and includes questions that require the candidate to evaluate and synthesize information and often to make a recommendation. In addition, the ICMA staff prepares a set of Learning Outcome Statements (LOS) with help from the Board of Regents. These statements expand on the CSO, stipulating exactly what the candidate needs to be able to do on the exam.

## Developing the Exam Questions

The raw material of a valid and reliable exam is a “good question”—a question that’s relevant and performs well on the exam. It’s important that CMA exam questions be written in a clear manner that’s free of ambiguities. ICMA uses a systematic approach for developing exam questions in which trained SMEs submit questions to ICMA staff.

Each question needs to have well-thought-out “distractors” or wrong answers that fully test the candidates’ ability to apply a concept. For example, Figure 1 illustrates a net present value (NPV) question and potential distractors.

The purpose of this question is to test a candidate’s ability to calculate an NPV. To accomplish this, the candidate must know that an NPV is based on cash flow (CF), not after-tax operating income (ATOI). He or she also needs to know that working capital recovery (WCR) in the final year (i.e., sale of all remaining inventory, collection of receivables, and payment of

all payables) is a valid net cash inflow with no tax implications. In addition, the candidate needs to know how to discount cash flows to determine the present value (PV) of project cash flows and then to create a “net” present value by subtracting the investment amount. The “good” distractors and the first two “miscalculations” provide plausible answers if a candidate doesn’t know exactly how to calculate an NPV. The remaining distractors are obvious wrong answers that would weaken the quality of an exam question if they were used as distractors.

When a trained SME submits potential questions, the ICMA staff considers each question’s topic for its link to the CSO and LOS and also for writing style, clarity, accuracy, spelling, and difficulty level. After ICMA professional staff edit the questions, exam review teams review them. These teams are composed of members of the Board of Regents and the Exam Review Committee, both volunteer committees of SMEs. On a regular basis, an ICMA staff member forwards a set of questions to members of the exam review teams. After each team member individually reviews every question, the staff member convenes a conference call to collectively discuss each question, including the appropriateness, wording, quality of the distractors, cognitive level, and accuracy. This evaluation step allows the review team members to eliminate unsuitable questions or make changes to improve a question’s quality.

Only those questions that undergo the rigors of this review are included on the exam. Even

then, they are included only as pretest questions or ungraded questions to test them for performance. The results are gathered and further analyzed to understand how the question worked. Is the question too difficult, too easy, or just about right? Did the question perform as intended? Questions that don’t pass this step are eliminated.

High-quality questions lead to high-quality exams, which, in turn, yield reliable results. Reliability for the CMA exams is computed through a number of standard statistical measures, and, to maximize reliability, staff ensures that only psychometrically sound questions are on the exam.

## Setting the Passing Standard

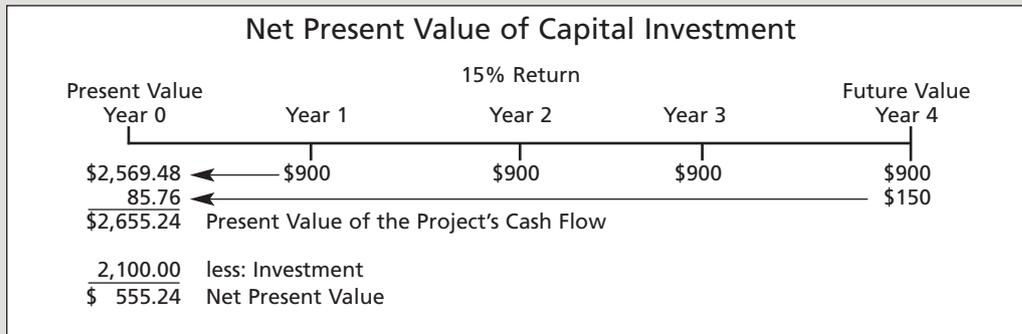
In addition to developing questions, ICMA also sets the passing standard for the exam, the required number of questions that must be answered correctly in order to demonstrate competence. The CMA exam is a rigorous, application-based exam. It also is a criterion-referenced test, which means that a fixed standard is used to determine whether a candidate meets a certain threshold or standard of performance—that is, the exam isn’t curved. ICMA uses an accepted procedure designed for determining the level of performance on the exams that constitutes passing. This procedure, called Modified Angoff, involves the collective judgment of the ICMA Board of Regents. Separate passing scores are established for each of the two exam parts.

When the Regents participate in one of these Angoff exam review sessions, they are given an exam to

Figure 1—Sample Question (numbers in 000s)

In a \$2,100 capital investment proposal, after-tax operating income (ATOI) is expected to be \$750, and net operating cash inflows (CF) are estimated at \$900 for four years. At the end of four years, there is an added cash inflow of \$150 for working capital recovery (WCR). If the marginal tax rate is 40% and the appropriate cost of capital is 15%, what value is closest to the net present value (NPV) of this project?

Correct Answer: \$555.24



**Good Distractors**

1. \$127 Uses ATOI (\$750)
2. \$469 No WCR
3. \$521 WCR taxed
4. \$ 41 ATOI & No WCR
5. \$ 93 ATOI & WCR taxed

**Miscalculation Distractors**

1. \$2,655 PV of CF
2. \$3,750 Total CF – No PV
3. \$ 729 12% Discount Rate
4. \$ (456) Random Number
5. \$ 895 Random Number

**Poor Distractors**

1. 2.33 years (PBP)
2. 27.26% (IRR)
3. True
4. Green

(Note: PBP = payback period; IRR = internal rate of return.)

answer and evaluate. The evaluation scales each question by considering, “If 100 qualified CMA candidates answered this question, how many of them would get it correct?” After each member completes this question set, the group discusses the collective results. The psychometrician who facilitates the process tallies the range of responses and reviews them with the group. When the scaling centers around the same general result (six members expected 60 out of 100, six more thought 55, and three members estimated 50), limited discussion ensues, and the difficulty rating is determined for that question. For some other questions, the range is broader. In the NPV example question, some team members might rate that as 75 out of 100 qualified CMA can-

didates should get that question correct. But other Regents may feel it would only be 40 out of 100. We have an open discussion, and each member is allowed to revise his or her assessment. On this second assessment, the ratings generally narrow. When a rating has been established for all the questions, the ratings for these 100 questions are added to yield a passing score for the exam. We use statistical techniques to equate different forms of the test so that all candidates are held to the same passing standard.

As we’ve noted, creating a valid and reliable certification exam is a rigorous, multistage process. Starting with the job analysis and working through the entire process of exam development and standard setting, the Board of Regents,

Exam Review Committee, and ICMA staff work as a team, creating quality and excellence through their passion for advancing the profession and elevating the CMA program. **SF**

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