

Enhancing Innovation in the EPC Industry

Implementation Resource 243-2



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Prepared by

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Introduction

Progressive managers realize that successful engineering-procurement-construction (EPC) organizations must be innovative in order to respond to today's ever-increasing dynamic environment. Yesterday's processes and resources simply will not meet client needs and deliver desired margins on tomorrow's projects. Understanding this reality, the construction industry has become interested in enhancing innovation and finding tools to help individual EPC organizations improve their innovative capabilities. Until the Construction Industry Institute (CII) and the Charles Pankow Foundation (CPF) sponsored Research Team (RT) 243, no such tool has existed for EPC organizations. At the outset of the study, RT 243 adopted the following definition of innovation: Innovation is the act of introducing a significant improvement in a process, product, or system that is novel to the organization, may cause individuals to view things differently, and results in competitive advantage, increased value for the client or benefit to stockholders.

After two years of research that included an extensive literature search on innovation within and beyond the EPC industry, and over 200 interviews and surveys, RT 243 developed the Innovation Maturity Model (IMM). This tool gives CII and CPF members a means for assessing their respective organizations' innovation-related capabilities and gives specific recommendations for improving the areas that most hinder their ability to innovate. The tool was validated and improved through pilot tests by a half-dozen CII and CPF member organizations during the team's third year of research. The purpose of this user's guide is to provide IMM users with detailed and comprehensive instructions for using the tool successfully. RT 243 adopted the following definition of innovation: Innovation is the act of introducing a significant improvement in a process, product, or system that is novel to the organization, may cause individuals to view things differently, and results in competitive advantage, increased value for the client or benefit to stockholders.

EPC organizations are those that provide engineering design, construction procurement and/or construction in one or more construction market segments, including the building, process, and infrastructure market segments.

Details about the IMM

The results of RT 243's literature search, interviews, and surveys indicate that there are 61 salient organizational attributes that facilitate the successful identification, adoption, and diffusion of innovations in the EPC industry. These attributes can be grouped into eight areas:

- culture
- resources
- risk perspective
- customer focus
- learning
- collaboration
- leadership
- processes.

The IMM asks users to respond to Likert-scale questions to report the extent to which a specific attribute is present within their organization. A brief set of recommendations for improving each attribute is also included in the IMM. Because not all attributes have equal impact, the research team established weightings for all 61 attributes. Some attributes can be considered more critical to the innovation process, while others are important but not as critical. The appropriate weighting for each attribute was drawn from the innovation literature review and through a Delphi approach. The weightings have been built into the Excel-based IMM tool.

How to Use the IMM

Figure 1 summarizes RT 243’s finding that many EPC organizations seem to value innovation, but these same organizations are weak in several of the eight attribute areas necessary to successfully and continuously innovate. When an organization completes the IMM, the results spreadsheet will automatically generate a maturity spider diagram reflecting your results

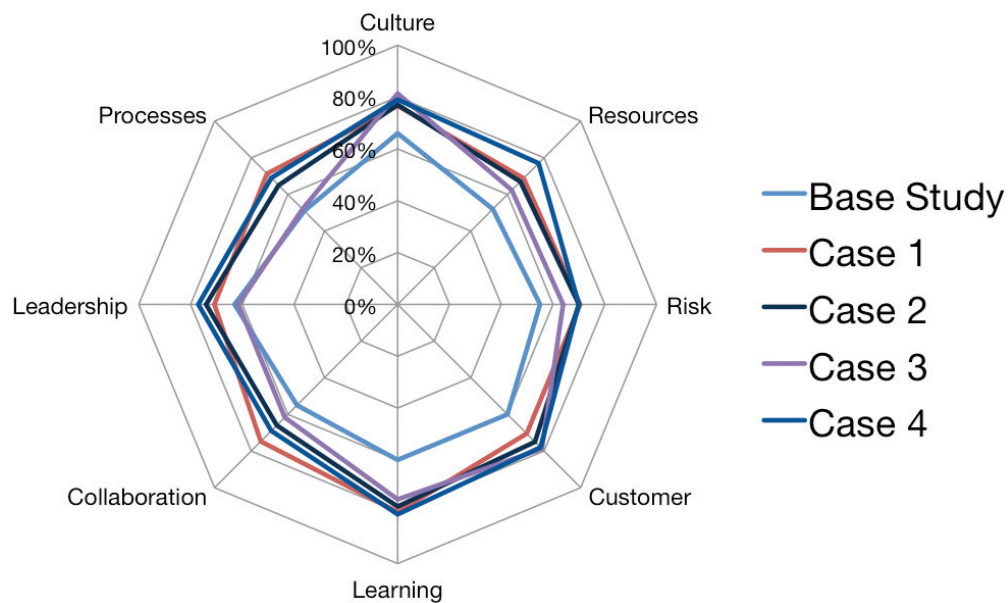


Figure 1. Problem areas

Step One: Identify the two IMM components

The IMM tool consists of two Excel 2007 documents, the “CII_IMM_243-2_Individual_Survey-v1.xlsm” should be distributed to individual survey respondents. As shown in Figure 2, this file includes directions for the respondent, the 61 statements that comprise the IMM evaluation tool, and drop-down scoring tabs for each question. The second file is named “CII_IMM_243-2_Results-v1.xlsm” and should be used by the administrator to analyze the results and tool-generated recommendations.

Step Two: Distribute the IMM individual survey to employees

Successfully using the IMM within an organization will likely require the commitment and availability of at least two individuals: one to champion the IMM and one to provide administrative support. Based on direction from the champion, the administrator should distribute the IMM survey to a representative sample of employees by email or through an organizational intranet.

RT 243 recommends that IMM users obtain between 20 and 100 completed surveys, depending on the organization's size and how important it is to the managers administering the IMM that the survey sample is representative of the entire organization. RT 243 members believe that innovation can best be improved if the survey is sent to a sample that is representative of the entire organization, including supervisory and non-supervisory personnel, home office and field office personnel, design, procurement, and construction personnel and personnel at different geographic locations. The research team recognizes, however, that there may be situations in which a set of managers wishes to limit the survey sample to a portion of the organization that will first pursue an innovation initiative.

The percentage of employees who should be surveyed will vary widely among organizations. Some organizations have a norm that all official surveys must be completed, while employees in other organizations are not required to complete surveys that do not interest them. Although completing the IMM survey should not require more than 20 minutes, the team recommends that respondents be given at least one to two weeks to complete the survey.

As shown in Figure 2, the IMM Individual Survey Excel file includes the following introduction and directions. The IMM administrator should edit this text as appropriate.

The Construction Industry Institute (www.construction-institute.org) established Research Team 243 to focus on how to expand and enhance innovation in the construction industry. The research team has defined innovation as follows: Innovation is the act of introducing improvement in a process, product or system that is novel to the organization and results in increased value for stakeholders. Based on an extensive literature search and nearly 200 interviews or surveys, the team created the Innovation Maturity Model for evaluating an organization's innovation capabilities. Your organization wishes to use this tool to assess its own innovation capability and requests your candid completion of this entire 61-item survey.

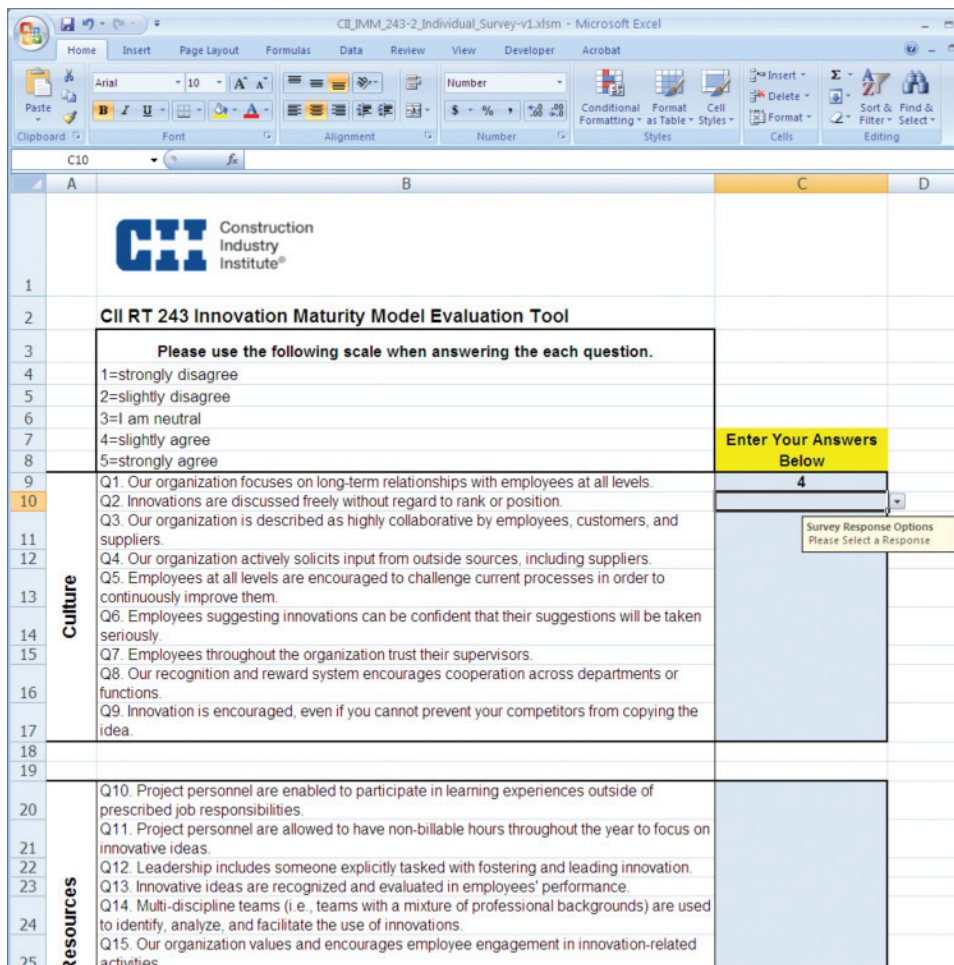


Figure 2. Screen capture from the first page of the IMM Individual Survey

The IMM administrator should still consider providing respondents with supplementary information, such as why the organization is conducting the survey (e.g., there is a strategic, organization-wide initiative on innovation), the deadline for completing the survey, and whether the survey collection process assures anonymity. Regarding the latter, please keep in mind that whenever possible, the anonymity of the respondents should be preserved to reduce the potential for biased results. The Excel-based survey currently does not allow respondents to add comments about individual questions, but the IMM administrator could modify the Excel file instructions and data collection process such comments would be helpful.

Step Three: Collect the surveys and compile the data

An individual within the organization should be in charge of collecting the completed IMM individual surveys and aggregating them into the **IMM Results** file. First, the IMM administrator should open the **IMM Results** file and then open each completed **IMM Individual** file. The data from Column C should then be copied (see Figure 3) and pasted into the appropriate column in the Raw Scores tab within the **IMM Results** file (see Figure 4). When pasting these ratings into the **IMM Results** file, start with Column D in the **Raw Scores** tab and work your way through to Column W. If you find that you need more columns, simply continue pasting into the subsequent columns (X, Y, Z, AA, AB, etc.) in the same manner, and adjust the range of cells in the average calculation in Column C in each of the 61 question rows of the **IMM Results** file (see Figure 5).

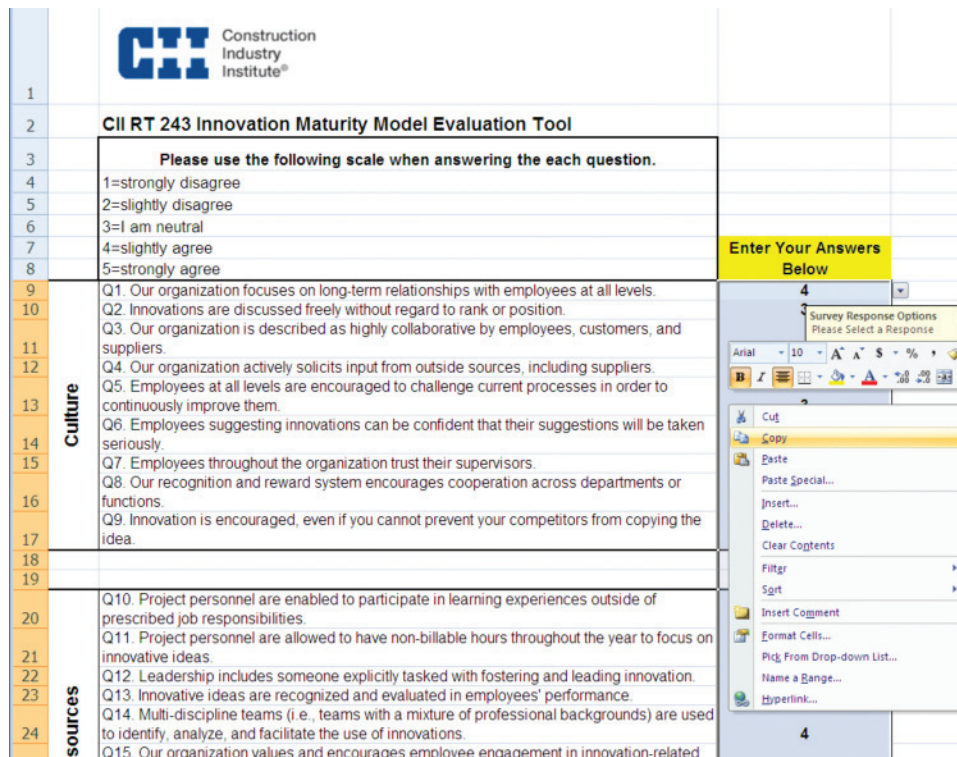


Figure 3. Copy scores from Column C of completed IMM individual surveys.

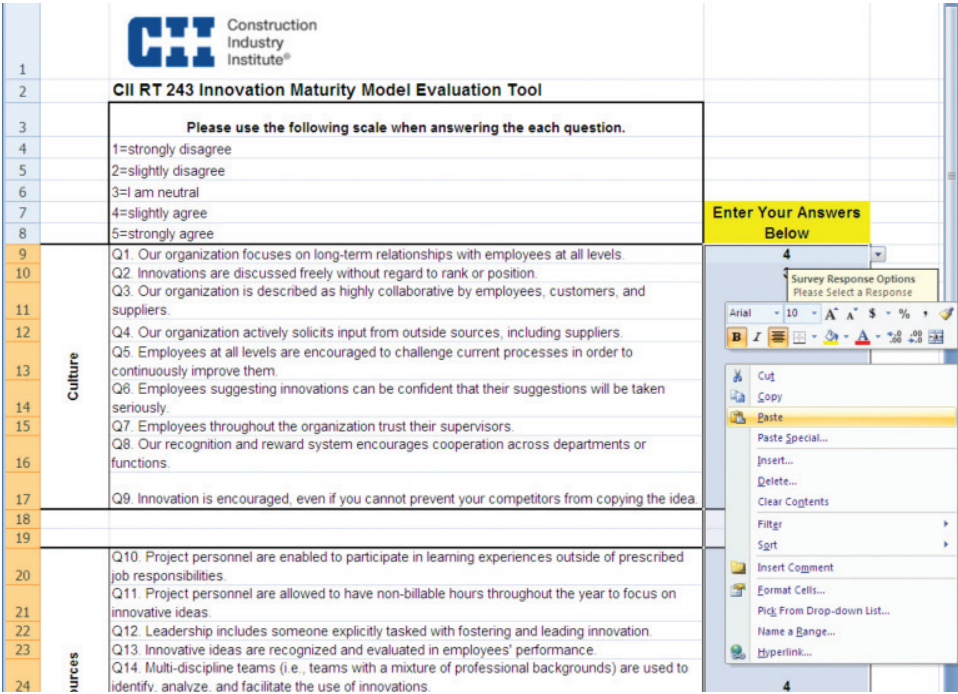


Figure 4. Paste scores from Column C of IMM individual surveys into IMM Results file.

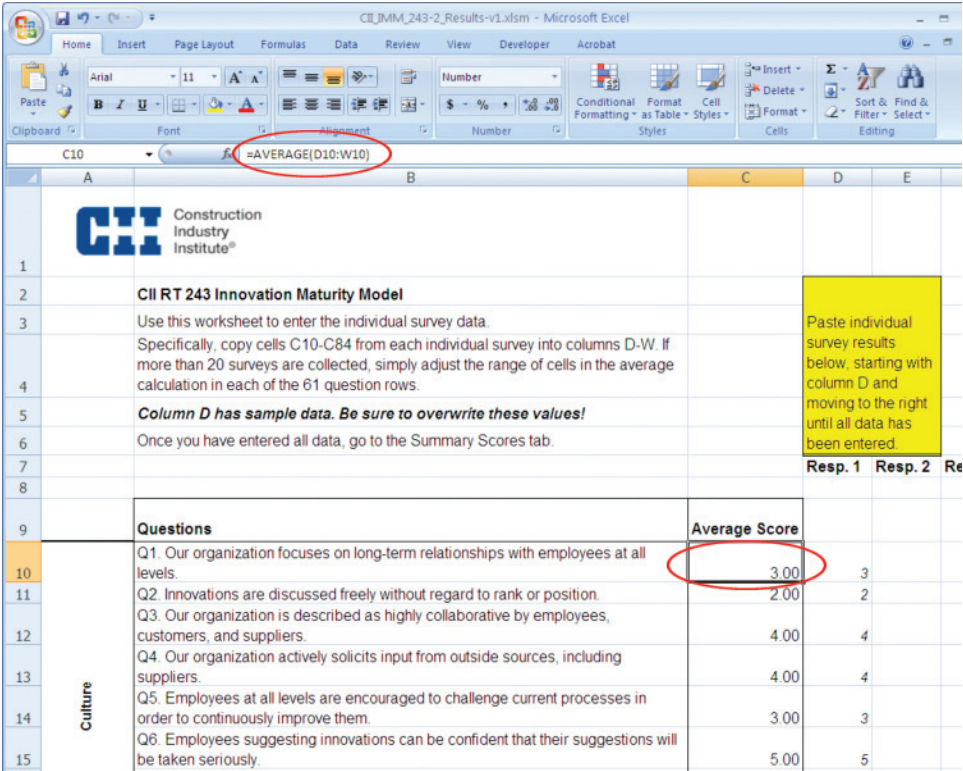


Figure 5. Adjust range in the calculations of average in Column C of the IMM Results file.

Step Four: Conduct analyses and view results

Once all of the data for all respondents have been copied and pasted into the **IMM Results** file, the data are ready to be analyzed. RT 243 has automated the analysis process using macro functions in Excel. In order to run the macros and obtain results for your organization, open the **Summary Scores** tab near the bottom of the screen. On this page, the user will find a spider diagram that summarizes the organization’s relative maturity in the eight major categories, and indicates the percent achievement in each category. This tab also includes a **Calculate Improvement List** button. (See Figure 6.) Click this button to run a macro and produce a customized summary. Once the macro has been run, the results and recommendations are ready for viewing. The results from the analysis are provided on two separate tabs.

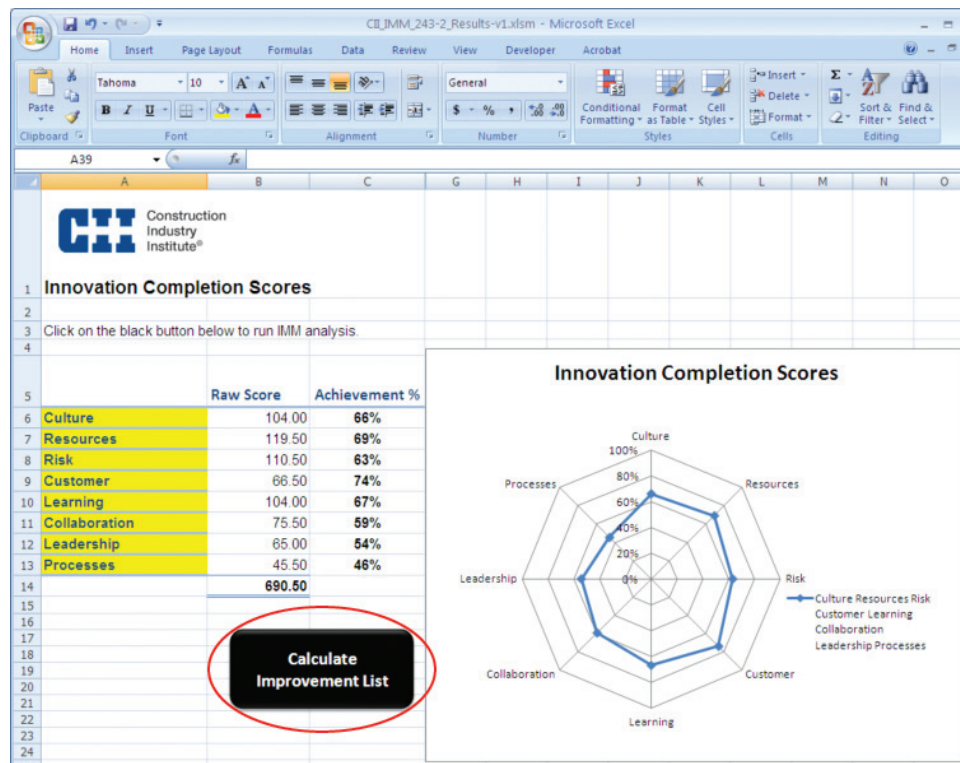


Figure 6. Click “Calculate Improvement List” to run macro.

Achievement Results

The first screen to analyze is the **Summary Scores** tab where the **Calculate Improvement List** button was just clicked. On this screen, two key results are provided: An Achievement Summary and an Achievement Diagram. The Achievement Summary is a quantitative table of the achievement the organization has made in each of the eight innovation areas. The numerical scores obtained from the survey and the individual weightings assigned to each question allow the user to calculate how an organization is performing in each of the eight categories. Specifically, by multiplying the individual question answers by the weighting factor for the individual questions, an achievement value is generated for each question. This value could range from a 1 in the case of an answer of 1 to a question with a 1 for a weighting value, to a 20 in the case of an answer of 5 to a question with the maximum weighting in the system of 4.

The sum of these values for the questions in an individual category provides the total achievement that an organization has obtained. (This value is reflected in the Raw Score column indicated in the table). Dividing this Raw Score value by the potential number of points that can be achieved in the category provides a percentage for the category. For example, in Figure 6, the organization has achieved 104 points in the culture category. Translated into a percentage, the 104 points represent a 66 percent achievement of the total possible points in this area. This score can be interpreted in two different ways. First, the score can be used as a comparison against the case average obtained by the team. The case average is provided in the **Improvement Potential** tab. Second, the score can be looked at as a report card. In these terms, the organization should be striving to achieve a mark of at least 80 percent, a score that indicates at least a Very Good result in a specific category. Since, in this example, the survey base as a whole did not demonstrate high marks in every area, the user should not set the low marks of the case study comparison group as an ultimate benchmark. Rather, these numbers should be used as a reference in setting milestones to reaching an intended or desired achievement level.

The second presentation of achievement provided by the IMM is the Achievement Diagram. As illustrated in Figure 6, the Achievement Diagram is based on a spider diagram. In this diagram, each of the eight areas is listed on an individual spoke on the diagram. The spoke is then divided into 20 percent increments that correspond to the 0-100 percent potential achievement percentage that can be obtained for each area. The achievement percentage

for each of the eight areas as listed in the Achievement Summary is then plotted on the appropriate spoke at the appropriate percentage level. A line is drawn between the values on each spoke to form the final achievement plot (i.e., the spider's web) on the diagram. This diagram is intended to be used as a graphical supplement to the Achievement Summary. It contains the same information as that provided in the chart, but is in a graphical format for ease of apprehension and communication.

An important note for the user to consider when viewing these results is that the Achievement Summary scores are not intended to provide an indication of specific innovation return. These scores are not equivalent to a project evaluation where a score above a certain threshold indicates that the project is in good health. Rather, these scores indicate a potential level of achievement that the organization has achieved in terms of fostering and supporting innovation. These scores should be interpreted in the context of sentences such as, *"The organization has achieved 66 percent of its potential in establishing a culture that supports innovation,"* or *"The organization has only achieved 54 percent of its potential in leadership in terms of supporting innovation."* Understood in this way, the scores provide an indication of how the organization is performing in terms of supporting innovation. However, the improvement of these scores will over time result in an improvement of the organization's capacity to support and implement innovation.

Improvement Potential

The second set of results provided by the IMM is the top 10 areas for innovation improvement. To view the top 10 areas for improvement, click on the **Top Issues** tab. The information included in this tab includes the average ratings for each attribute obtained from your organization's sample, the maximum score (5), the difference, and the relative weighting for that attribute. (See Figure 7.) The inclusion of weighting in this step means that the top recommendations will not be simply the attributes with the lowest average scores. More importantly, this tab shows the improvement potential for the top 10 improvement areas. The Innovation Potential is calculated for each question by subtracting the actual answer from the maximum potential and then multiplying this result by the weighting factor. For instance, an individual question may receive an average score by the respondents of 3.5. The difference between the potential maximum and the actual average would be 1.5. This value would then be multiplied by the importance weighting given to that question as defined in the IMM. If the

No.	Question	Average	Max Score	Difference	Weighting	Improvement Potential	Recommendation
24	Q24. Failures and mistakes are viewed as opportunities for learning	1.0	5	4.0	4	16.0	A learning organization should be able to turn failures into positive learning experiences. There can be numerous root causes for a failure, but many can be attributed to misapplication, miscommunication, or a poorly understood goal or issue. Furthermore, to achieve a long-term goal or objective the organization may go through many iterations or "failures" before the solution comes into focus. Elevating learning to an organizational priority involves critically assessing an event, engaging the right stakeholders, and recommending the next step of evolution based on the current experience.
60	Q60. Our organization has an established process for obtaining corporate funds and resources to support innovation activities.	1.0	5	4.0	4	16.0	The most common explanation for a company's lack of innovation is that no time, funding, or resources are devoted to implementing innovation or to changing the way things are done. Project teams are bound to contractual constraints with customers and partners, making it difficult to diverge from the tried and true. Establishing a budget and allowing time for investigating ideas at the company or group level will enable the selection of the best opportunities. If proven out, these opportunities can be proactively implemented on a broader scale.
17	Q17. Funding for innovation is available from corporate sources, not just project budgets.	2.0	5	3.0	5	15.0	Firms that value innovation as a core value put corporate-level resources in place to fund innovation. A low score in this area indicates a need to consider ways to indemnify project managers with corporate support for innovations proposed at the project level. A second approach to applying corporate funding is to consider spreading costs of expenditures for innovations over multiple projects. Another possible approach is to consider joint ventures with owners, other contractors, or equipment suppliers.
37	Q37. Individuals actively share and transfer knowledge	1.0	5	4.0	3.5	14.0	Knowledge that is isolated in a single individual is significantly less valuable to an organization than knowledge that is widely disseminated. Shared knowledge is knowledge that is leveraged by multiple individuals into broader organizational advances. The organization should make it a priority to develop technology that enhances knowledge-sharing, and to create incentives for individuals to share and transfer knowledge to others with similar technical or managerial interests.

Figure 7. Customized report from the Top Issues tab

weight of the example question is 3, then the overall Innovation Potential for that individual question is 4.5. The IMM uses this Innovation Potential Rating to rank the average value for each of the 61 questions, from the greatest opportunity for innovation enhancement to the lowest opportunity. The attributes with the top ten improvement potential scores are included in this tab. These may be considered as the low-hanging fruit for your organization, or as the areas that have the greatest opportunity to return results if addressed.

In addition to the numeric ratings presented in the **Top Issues** tab, each of the ten questions is presented with a recommendation for improving the attribute. Each recommendation provides a succinct discussion of the issue associated with the question and a possible path to enhance the score for that issue. The recommendations do not dictate a specific set of tasks to be followed, since the research team determined that each organization will have a different set of circumstances relative to the area in which the score emerged. As such,

the recommendations should be viewed not as a definitive action plan, but as a starting point for conversations that can lead to developing a roadmap for addressing an individual area for improvement.

While the report in the **Top Issues** tab is the most important output of the analysis, additional information is available in the **Improvement Potential** and **IP Rankings** tabs. Specifically, the Improvement Potential page includes the improvement potential scores for all 61 questions and is organized by the eight categories. The IP Rankings page includes all 61 questions, ranked by their improvement potential. The user may use this tab to quickly review the organization's strengths and weaknesses.

Step Five: Share results with colleagues and create specific action items

The IMM champion should share the resulting reports with colleagues within the organization (particularly the Top Issues report with recommendations). The recommendations should be evaluated by multiple personnel in the organization in order to devise specific action items that can be integrated with current initiatives or specific business practices. As stated above, the recommendations should be viewed as a starting point for conversations about improving innovation capability. One of the key virtues of the model is its ability to stimulate conversations within the organization. The process of implementing the model, if done with extensive discussion and interaction, can lead to a much greater awareness of a company's innovation potential.

RT 243 recommends targeting three to five attributes by implementing specific action items. It is also advisable, after these action items have been implemented, to have at least some of the same respondents—as well as new respondents—complete the IMM tool to see if improvement has occurred. (The team recommends this second use of the tool three to 12 months after the action items have been put into effect.) Note that it is possible that average scores for the attributes that were targeted for improvement or for other attributes may actually go down. Rather than the organization actually becoming less capable of innovation as a result of actions taken, the reduction in scores likely reflects a heightened sensitivity towards innovation and higher expectations for the organization. For example, if you rate yourself on your cooking abilities then take a two-day cooking class and rate yourself again, you are likely to rate yourself lower in some areas after you take the class. The class actually improved your culinary abilities but also made you aware of how much more you needed to learn.

Closing Remarks

This guide is intended to give users step-by-step instructions for using the IMM. The strengths of the IMM are the following:

- draws on numerous articles and books on innovation.
- is based on data from over 200 EPC professionals.
- has been pilot tested and validated by several large EPC firms.
- collects input from a stratified and representative sample of employees.
- identifies specific areas where the potential for improvement is greatest.
- provides recommendations for enhancing innovation capabilities.
- should stimulate fruitful discussion on what specific actions should be taken within the organization.

RT 243 would like to express its gratitude to CII and to the Charles Pankow Foundation for funding this research. The team also would like to thank the many individuals who participated in this study, and the CII members who have expressed interest in the tool. RT 243 would like to give special recognition to the case study firms; these organizations invested a great deal of time and took risks to participate in this study. Their input was invaluable to the outcome of the project.

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