PAPERS

Contemporary Knowledge and Skill Requirements in Project Management

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ABSTRACT

This article provides an overview of some recent developments within the field of project management and presents metrics used to assess current trends within the discipline in order to identify its future direction. Graphical tools are introduced to measure the span and areas of emphasis within project management, such as radar diagrams and the recently introduced International Project Management Association (IPMA) "Eye of Competence." The research shows that the discipline seems to focus increasingly on interpersonal competences, relationship management, resource management, and strategic alignment. The results are evaluated and discussed, and the article concludes with some ideas about the future development of project management.

KEYWORDS: metrics; eye of competence; categories of project management

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INTRODUCTION

What knowledge and skills are essential for a competent project manager in the present-day context? To address this question, one can start by looking at two well-recognized definitions of project management. On the one hand, the Project Management Institute (PMI) defines project management as "the application of knowledge, skills, tools, and techniques to project activities to meet project requirements" (PMI, 2004). On the other hand, the International Project Management Association (IPMA) states: "Project Management (PM) is the planning, organising, monitoring, and controlling of all aspects of a project and the management and leadership of all involved to achieve the project objectives safely and within agreed criteria for time, cost, scope, and performance/quality. It is the totality of coordination and leadership tasks, organisation, techniques, and measures for a project. It is crucial to optimise the parameters of time, cost and risk with other requirements and to organise the project accordingly" (IPMA, 2006). Although these are useful definitions, they are rather wide and therefore do not give a comprehensive answer to the question of what knowledge and skills must be mastered by the project manager in the future in order to excel—an issue that is of importance not only for project managers, project sponsors, clients, customers, contractors, and other project stakeholders, but especially for everyone who is training future project managers.

The project management profession has in the past strongly emphasized technically supported methods of planning and execution as a core competence, and continues to do so today. However, while project management today remains firmly focused on this traditional "objective" or "hard" perspective, there seems now to be an increasing focus on the more "subjective" and "soft" factors—leadership, motivation, group dynamics, interpersonal communication, culture, and ethics—that could be regarded as essential to all professional endeavors.

In light of this, we see that the PMI and IPMA definitions of project management do not provide a comprehensive or all-inclusive description of project management as such, and that they do not take into consideration the development that project management has undergone and the extent to which it has changed since it was first formally defined in the middle of the twentieth century. This development has, however, been discussed in a number of textbooks and papers.

Kerzner (2006) gives an overview of project management from 1945 to 2006 and highlights the development, over three different periods, of non-project-driven enterprises into hybrid enterprises that are primarily production-driven but also include numerous projects. The present-day situation and the future will, according to Kerzner, focus on project-driven enterprises, where the project manager has profit-and-loss responsibilities and where

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project management is a recognized profession.

Milton D. Rosenau Jr.'s textbook on project management, *Successful Project Management: A Step-by-Step Approach* (Githens & Rosenau, 2005), is a well-established work in its field. In connection with the release of the fourth edition of the book, an interview with the author was published in *C2M Journal* under the title "What's New in Project Management?" (Scanlan, 2006). Asked about what changes had actually taken place since the release of the third edition in 1998, Rosenau replied that little, in fact, had changed in project management as such. He observed, however, that project management as a profession has undergone tremendous growth in the past few years, as can be seen, for example, in the increased number of project management professional (PMP®) credential holders certified by PMI, rising from 10,000 in 1998 to 100,000 in 2004.

Jugdev and Müller (2005) discuss the way our perception of project success has changed over the past 40 years, and they retrospectively identify three distinct periods: The first (1960s–1980s) was the "project implementation and handover period"; the second (1980s–1990s) was the "project critical success factor (CSF) list period"; and the third (1990s–present) is the "CSF framework period." They suggest that the next one will be the "strategic project management period."

The applications of project management methodology seem, therefore, to be expanding. It is increasingly being used as a general management tool, as suggested by Kerzner (2006) and as supported in the findings of Jugdev and Müller (2005), and is being used by an increasing number of people in all sectors of business, as pointed out by Rosenau (Scanlan, 2006). This means, though, that project management, if it is to be viewed as a general toolbox for the manager, must be well equipped enough to be applicable in all business sectors and must include a wider range of dynamic management tools than it did in the earlier days.

A recent publication, *Competencies in Project Management, National Competence Baseline for Scandinavia* (Fangel, 2005), points in this direction; according to its author, the competencies of modern project managers are now to be based on the intertwining of leadership behavior, project management experience, and competence in traditional project management methods. This new way of thinking is supported by the *IPMA Competence Baseline v. 3* (2006), issued in June 2006, which illustrates the necessary competences of the modern project manager by the innovative "Eye of Competence" and where contextual, behavioral, and technical competences are all represented. This diagram has been an eye-opener for the field.

Other standards, such as *A Guide to the Project Management Body of Knowledge (PMBOK® Guide*—Third edition) (PMI, 2004) and ISO10006:2003 (International Standards Organization, 2003), do certainly define project management in terms of a coherent body of knowledge; however, they seem to reflect somewhat outdated viewpoints. This is undesirable, as project management as a discipline is, and should be, dynamic and in a state of incessant development. For this reason also, the question of what knowledge and skills will be needed in the future for the project manager to excel can probably never be fully answered. The history of project management points to an ongoing maturation process, requiring our answers to this important question to be modified from one period to the next. The objective of the present article, however, is to answer this question for the current period.

Previous Research and This Study

Many researchers have attempted to define measurements to identify the most crucial elements of project management and have done so by analyzing various sources of information. Zobel and Wearne (2000) analyzed the relative frequency of attention to different project management body of knowledge topics in some of the papers presented at PMI and IPMA seminars, symposia, and congresses during the period 1996–1998. A total of 44 important topics were identified and used as a reference guide. Urli and Urli (2000) used a "scientometric method" of text in order to identify tendencies in the association of *keywords* in the electronic database ABI-INFORM in all papers published between 1987 and 1996 that were considered relevant to project management. The method, which was not based on any previous classification, was meant to illustrate what the presenters themselves deemed the most significant elements.

In a paper by Crawford, Pollack, and England (2006), the highlighted trends within project management literature in the period 1994–2003 were identified based on an analysis of articles in the *International Journal of Project Management* and in the *Project Management Journal*. Their objective was to provide an overview of how the discipline might be changing by using as a basis for analysis a list of 48 project management topics covering 18 main topic categories. These categories and topics are shown in Table 1.

Following in the footsteps of these studies, our main purpose here, however, is to explore the use of a new metrics that can be used to assess the current status of the discipline of project management. We have, therefore, developed some graphical representational tools for this purpose. We believe that these tools can be applied to gauge different information sources in order to provide a more holistic view of project management as a discipline in both the present and the future. One reason for the study (other than to contribute something of interest for the *Project Management Journal* and our interested colleagues) was to create a comprehensive overview of information in order to be

Category	Topics
Cost management	Cost management
Cross-unit outcomes	Estimating Integration management Project context/environment Project life cycle/phasing
Finalization	Project closeout/finalization Testing, commission, handover, and acceptance
Interpersonal	Conflict management Leadership Negotiation Problem solving Teamwork
Legal issues	Legal issues Regulations Safety, health, and environment
Marketing	Marketing
Product functionality	Configuration management Design management Requirements management Technology management Value management
Program management	Program management
Project evaluation and improvement	Organizational learning Performance management Project evaluation and review
Project planning and control	Change control Project monitoring and control Project planning
Project start-up	Goals, objectives, and strategies Project initiation/start-up Success [criteria and factors]
Quality management	Quality management
Relationship management	Benefits management Document management Information and communication management Reporting Team building and development
Resource management	Personnel/human resource management Procurement Project organization Resource management
Risk management	Risk management
Scope management	Scope management
Strategic alignment	Business case Financial management Project appraisal Strategic alignment
Time management	Time management

Note: From Crawford, L., Pollack, J., & England, D. [2006]. Uncovering the trends in project management: Journal emphases over the last 10 years. *International Journal of Project Management, 24*[2]. Reprinted [or Adapted] with permission.

Table 1: Project management categories and corresponding topics.

better equipped to continue our development of a new graduate program in project management (Master of Project Management) at the Faculty of Engineering at the University of Iceland (further information can be obtained at www.mpm.is). The graphical tools that we developed are principally used to assess the current status of the discipline of project management in terms of education and demands for competence in the year 2008, by analyzing the following three sources of information:

- selected textbooks on the subject published in or after 2003;
- papers published in the *Project Management Journal* and the *International Journal of Project Management* in the period 2003–2008, and
- 17 Master of Project Management (MPM) programs, in the United States, Australia, and Europe.

Research Method

For this purpose, two different measurements were used. The first metric is based on the 18 categories suggested by Crawford, Pollack, and England (2006). In addition to the 48 topics listed in Table 1, however, more references were needed in order to map the data into the 18 categories, and in order to obtain this objective, Kerzner (2006), PMI (2004), PMI (2005), and Wideman (2006) were used. These categories were then transformed into a graphical diagram based on two main dimensions used to suggest the further arrangement of the categories: (a) the horizontal leadership–craftsmanship dimension reflects the balance between leading the project and the project work itself, and (b) the vertical strategy-execution dimension reflects the balance between setting strategy and executing it.

In order to locate the different categories within the dimensions, we called on a panel of 24 project management experts, all of whom had at least a master's degree in the field and were actively working as project managers in businesses or in the public sector. By using a data sampling through a simple

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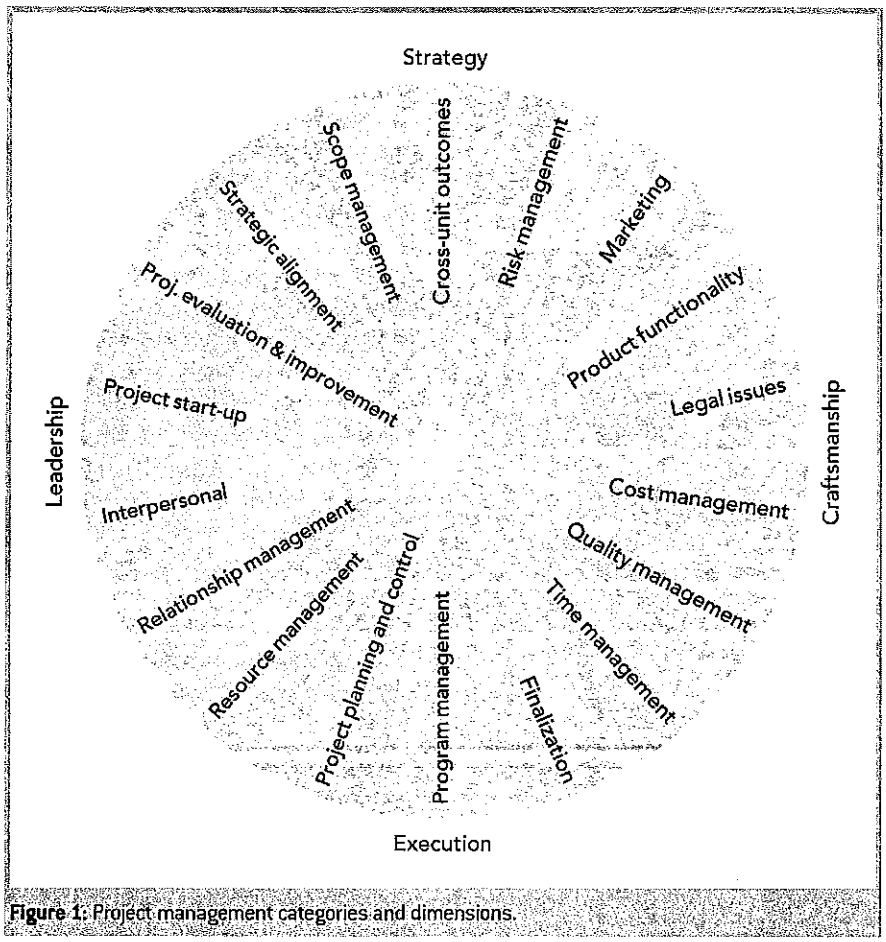

Figure 1: Project management categories and dimensions.

Web-based survey, the participants were asked to place each category within each of the two dimensions. The graphical instrument used is the 360° radar diagram and is shown with the survey's results in Figure 1. Only the 18 main categories are shown, but the remaining 48 topics, mentioned before, were used as a reference guide for arranging the data from each information source in the apposite place within the diagram.

The data was then mirrored into the radar diagram in such a way that the most important category for each of the three sources of information scored 100% (full slice), and the other categories scored relatively on this basis (i.e., their relative importance is represented on the basis of their area within the slice). In this way, the radar diagram represents the internal relative importance of all the categories for each source of information used in the study: journal articles, master's programs, and recent textbooks.

The second metric is based on the "Eye of Competence" (EOC) introduced in 2006 by the IPMA. The EOC is shown in Figure 2.

The subjects that fall under each of the three competences are as follows:

- *Behavioral competences:* Leadership, engagement and motivation, self-control, assertiveness, relaxation, openness, creativity, results of orientation, efficiency, consultation, negotiation, conflict and crisis, reliability, value appreciation, and ethics.
- *Contextual competences:* Project orientation, program orientation, portfolio orientation, project program and portfolio implementation, permanent organization, business, systems products and technology, personnel management, health, security, safety and environment, finance, and legal.
- *Technical competences:* Project management success, interested parties, project requirements and objectives, risk and opportunity, quality, project organization, teamwork, problem resolution, project structures, scope and deliverables, time and project phases, resources, cost and finance, procurement and contracts, changes, control and reports, information and documentation, communication, start-up, and closeout.

Based on these three main areas of competences and their corresponding

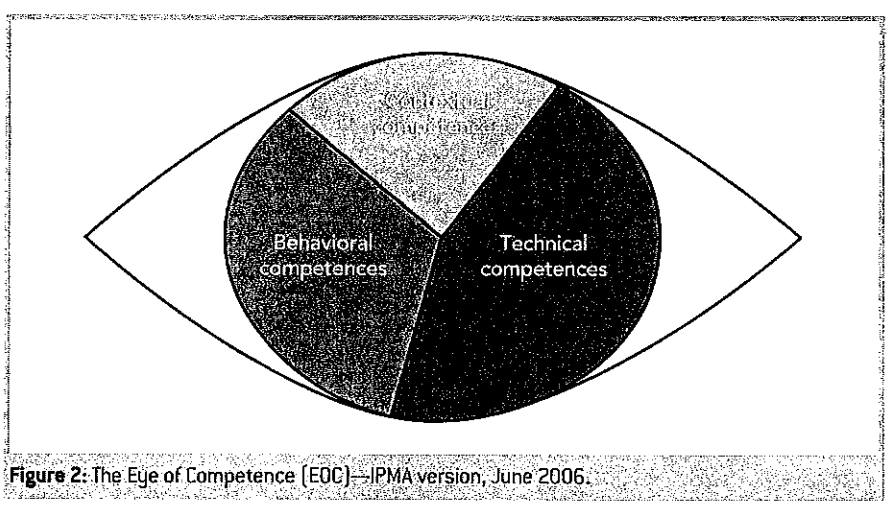

Figure 2: The Eye of Competence (EOC)—IPMA version, June 2006.

subjects, the data (i.e., the defined categories identified in the survey described above) were then further mapped into the proper competences and subjects of the EOC. The relative balance between the competences was calculated and represented in a pie chart, which revealed our findings in a specific corresponding version of the EOC for each source of information.

Results

Papers in the Project Management Journal *and* International Journal of Project Management

All papers published in the *Project Management Journal* and the *International Journal of Project Management* during the period June 2003–February 2008 were registered, including titles, authors, and keywords. A total of 2,338 keywords were found in 484 papers. Keywords that were too general or too broad were omitted—for example, "project management" (81 occurrences), "studies" (47 occurrences), and "managing projects" (56 occurrences)—as were keywords indicating countries and specific project types. In all, 687 keywords were omitted, and the analysis was based on the remaining 1,651 keywords. The mapping is shown in Figure 3.

The mapping of the article keywords into the 18 categories shows that three categories were dominant: *interpersonal competences, resource management,* and *strategic alignment,* followed by *relationship management.* These seem, according to our findings, to be the areas in which most active research is currently occurring within project management. This focus in research will probably influence the direction that project management will take during the coming years, and its impact can already be seen in the focus of some cutting-edge master's-degree programs in project management. We discuss this focus in research in the next section.

Graduate Programs in Project Management

The MPM is far from being as established as an MBA degree. Increasing numbers of universities are, however, offering specific graduate programs that focus on project management. In order to obtain some indication of the educational focus of these programs, 17 programs were selected for evaluation. The selection was based on an extensive Web exploration in which the selection criteria were that the program was on a master's-degree level, that it was offered by a recognized university, and that sufficient information on the program was available online for the analysis. The following programs were included:

- Euro Master of Project Management. University of Applied Sciences Dortmund (Germany), University of the Basque Country (Spain), Norwegian University of Science and Technology (Norway), University of Zaragoza (Spain), ESC (France), and University of Maribor (Slovenia) (EuroMPM, 2008);
- Master of Project Management, Pennsylvania State University (United States) (Pennsylvania State University, 2008);
- Master of Project Management, University of Iceland (Iceland) (University of Iceland, 2008);
- Master of Project Management, Bond University (Australia) (Bond University, 2008);
- Master of Project Management, Edith Cowan University (Australia) (Edith Cowan University, 2008);
- Master of Project Management, Keller Graduate School of Management (United States) (Keller Graduate School of Management, 2008);

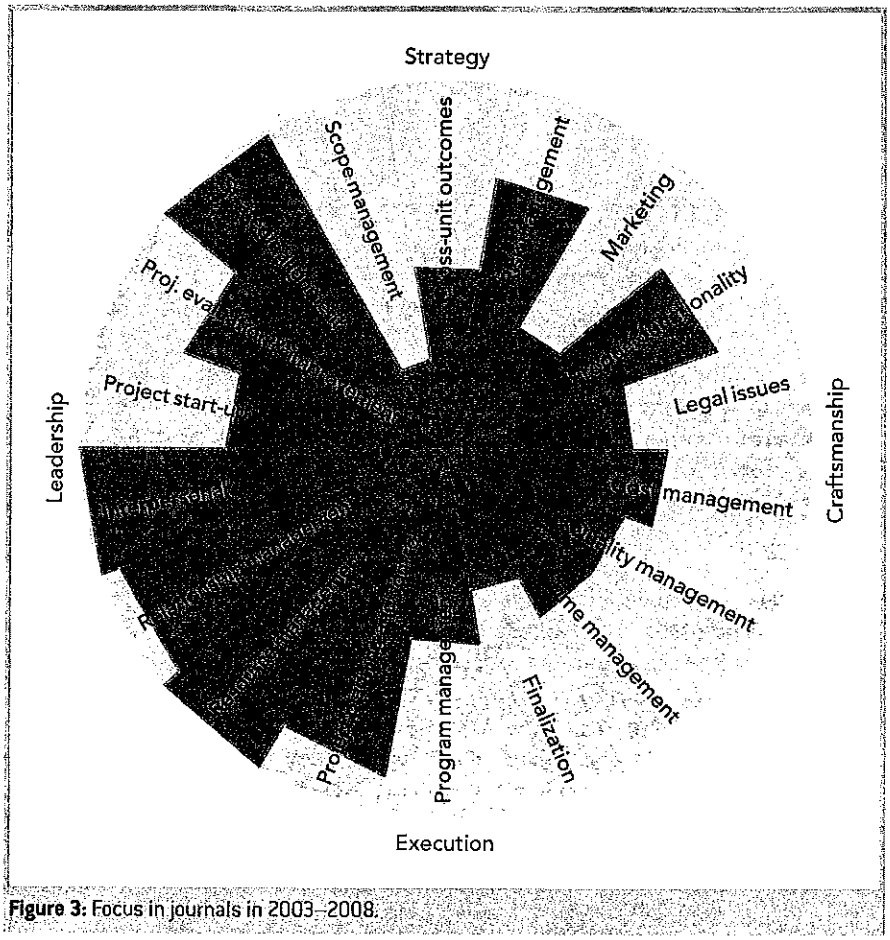

Figure 3: Focus in journals in 2003–2008.

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- Master of Project Management, Queensland University of Technology (Australia) (Queensland University of Technology, 2008);
- Master of Project Management, University of Queensland (Australia) (University of Queensland, 2008);
- Master of Project Management, University of South Australia (Australia) (University of South Australia, 2008);
- Master of Science in Project Management, City University of Seattle (United States) (University of Seattle, 2008);
- Master of Science in Project Management, George Washington University (United States) (George Washington University, 2008);
- Master of Science in Project Management, Royal Institute of Technology (Sweden) (Royal Institute of Technology, 2008);
- Master of Science in Project Management, University of Alaska (United States) (University of Alaska, 2008);
- Master of Science in Project Management, University of San Francisco (United States) (University of San Francisco, 2008);
- Master of Project Management, Syddansk Universitet (Denmark) (Syddansk Universitet, 2008);
- Stanford Advanced Project Management (United States) (Stanford University, 2008); and
- Master of Science in Strategic Project Management, Heriot-Watt University (Scotland), Politecnico di Milano (Italy), Umeå School of Business and Economics (Sweden) (Anonymous, 2008).

A total of 24 universities in Europe, Australia, and the United States are involved, in one way or another, in running the 17 graduate programs listed. The analysis of the programs was based on both course descriptions and the number of credits given for the completion of each course, which then combined to yield the weight of the different categories in each program. All of the programs have an equal weight in the outcome. Their coalesced educational focus in terms of our 18 categories is represented in Figure 4.

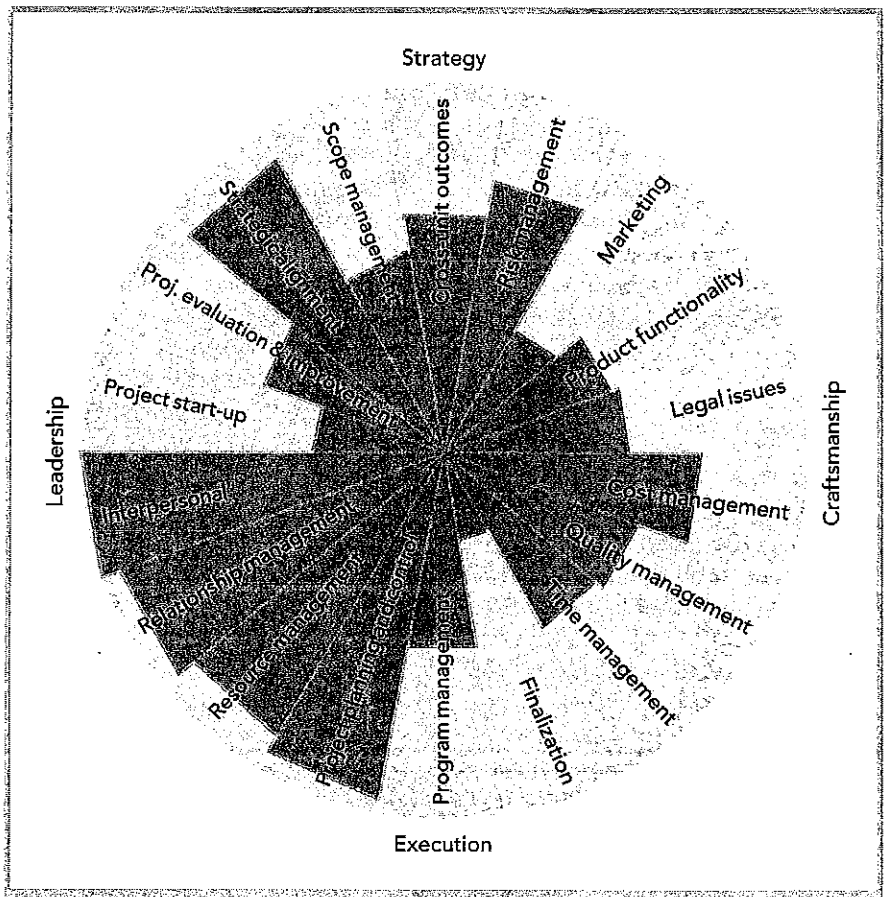

Figure 4: Focus in graduate project management programs in 2008.

The radar diagram shows that three categories are dominant: *interpersonal, strategic alignment,* and *project planning and control,* followed closely by *relationship management.* There is, interestingly, a low score in the category *finalization.* These results are quite consistent with those demonstrated in Figure 3, which illustrated the focus of research topics in journal articles. It is not unreasonable to expect that in the future these master's-degree programs will increase their focus on resource management and product functionality and that the research being conducted in these areas will be disseminated in those programs.

Textbooks on Project Management

The last source of information that we examined was professional books on project management. A large number of works on project management are available and many of them are university textbooks. For the purpose of this study, we selected a number of these textbooks based on a search on the www.amazon. co.uk Web site on May 1, 2008. The search term was "project management," and the search was limited to books published in 2003 or later. Books that were too specific or too specialized were omitted from the list, such as books on specific project management software, and only books that were over 200 pages in length were included. The final list consisted of the following 21 books:

- *A Guide to the Project Management Body of Knowledge (PMBOK® Guide;* PMI, 2004),
- *Project Management for Dummies* (Portny, 2007),
- *Project Management* (Maylor, 2005),
- *Software Project Management for Dummies* (Luckey & Phillips, 2006),
- *Information Technology Project Management* (Schwalbe, 2005),
- *Guide to Project Management* (Roberts, 2007),
- *IT Project Management: On Track from Start to Finish* (Phillips, 2004),
- *Project Management* (Lock, 2007),
- *Project Management in Construction* (Walker, 2007),
- *Project Manager: Mastering the Art of Delivery in Project Management* (Newton, 2005),
- *Reinventing Project Management: The Diamond Approach to Successful Growth and Innovation* (Shenhar & Dvir, 2007),
- *Software Project Management* (Hughes & Cotterell, 2006),
- *The Definitive Guide to Project Management: The Fast Track to Getting the Job Done on Time and on Budget* (Nokes, 2003),
- *The Handbook of Project Management: A Practical Guide to Effective Policies, Techniques and Processes* (Young, 2007),
- *Project Management: A Managerial Approach* (Meredith & Mantel, 2006),
- *Project Management—A Systems Approach to Planning, Scheduling, and Controlling* (Kerzner, 2006),
- *Project Management—Planning and Control Techniques* (Burke, 2003),
- *The Fast Forward MBA in Project Management* (Verzuh, 2005),
- *PRINCE2 Revealed: Including How To Use PRINCE2 for Smaller Projects* (Bentley, 2006),
- *Project Management: The Managerial Process* (Gray & Larson, 2006), and
- *Project Management: A Strategic Planning Approach* (Gardiner, 2005).

Once the list was defined, the content of each of the 21 books was mapped into the 18 categories on the basis of chapter and subchapter titles and their lengths. Each book was given the same weight in the final representation, and their focus in terms of content mirrored in our 18 categories is shown in Figure 5.

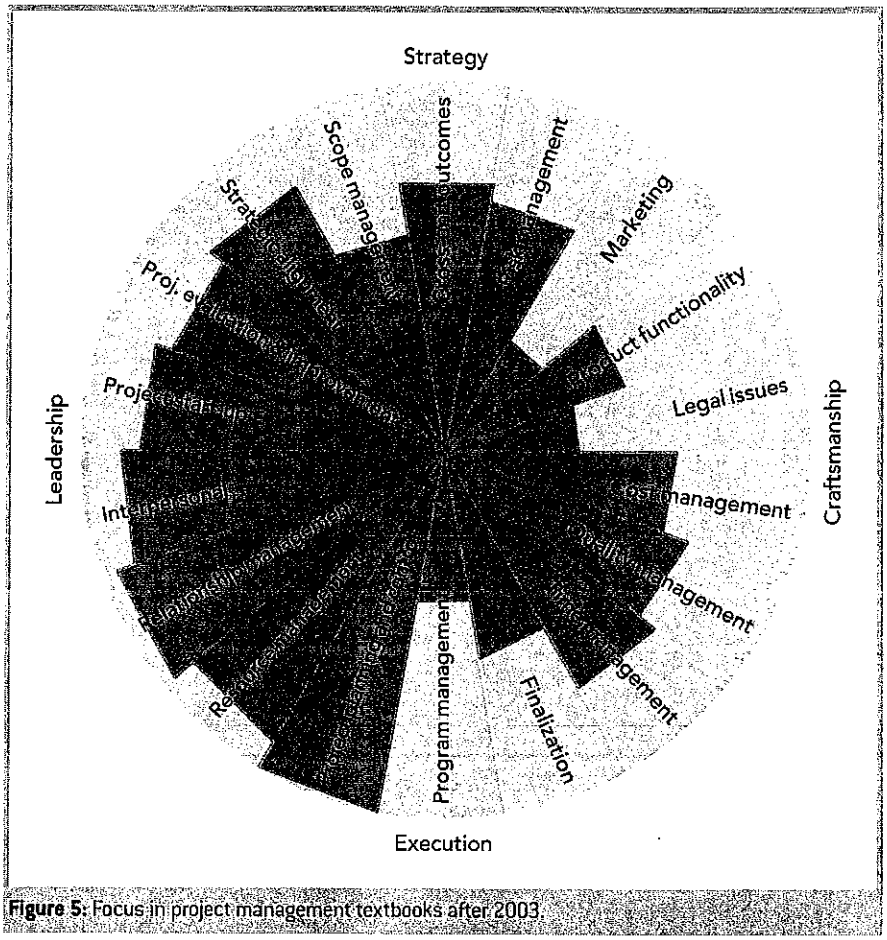

Figure 5: Focus in project management textbooks after 2003.

This diagram indicates that the selected textbooks put the strongest emphasis on *project planning and control, relationship management,* and *resource management.* There is little focus on *program management, marketing,* and *legal issues.* These findings also fit well with the previous findings. The strong emphasis on project planning and control in project management textbooks is not unexpected, and, based on what seems to be the trend in research, we might expect a stronger focus on strategic alignment and interpersonal competences in project management textbooks in the coming years.

Holistic View

The information presented thus far can further be consolidated in such a way as to provide us with an overview of the entire current situation. By drawing a single radar diagram that includes all of our findings as illustrated in the previous diagrams, we get the representation demonstrated by Figure 6, which shows the entire picture covering all of our three sources mirrored in the 18 categories.

The variation in emphasis on the 18 different categories is striking: *interpersonal, relationship management, resource management, project planning and control,* and *strategic alignment* are all areas of strong focus, whereas there is much less focus on *marketing, legal issues, finalization,* and *program management.*

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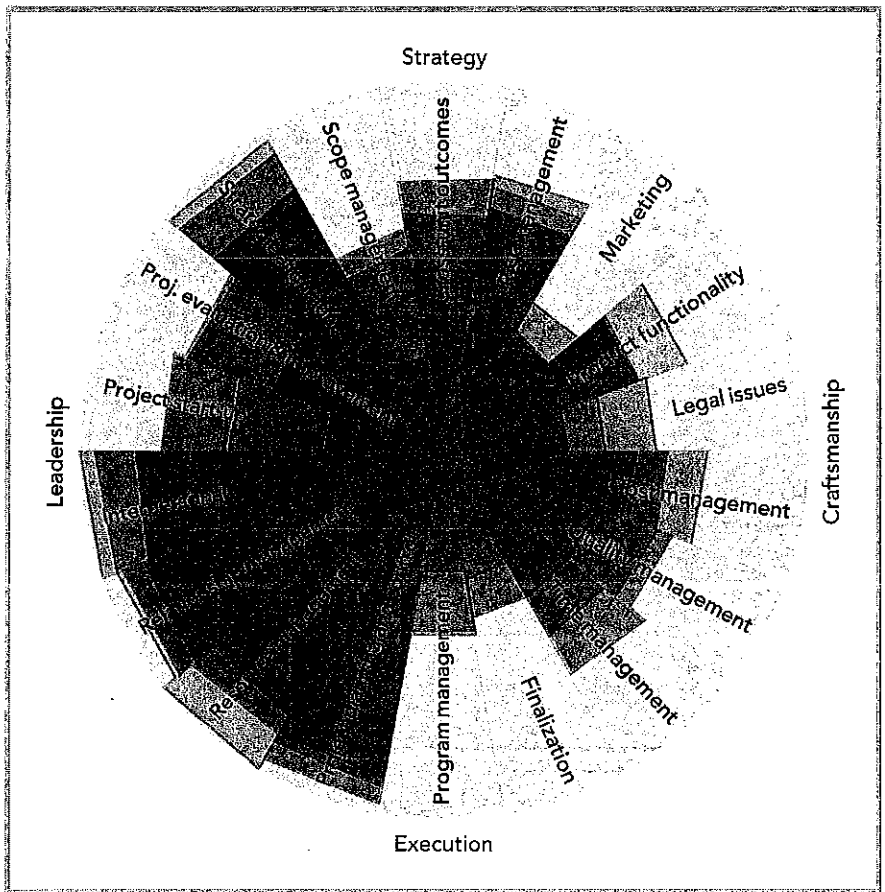

Figure 6: Combined view of project management.

Another way to represent our findings is to produce a still new perspective by reflecting the information from the three sources into the three competences of the newly introduced EOC. The results are shown in Table 2.

Combining the three diagrams thus obtained yields the representation given in Figure 7.

In the picture, the shaded areas represent an overlap between the different sources. In general, however, this view is quite consistent with the relative weight of competences as exhibited in the original IPMA EOC (Figure 2). Technical competence is still the most important feature of professional project management, followed closely by behavioral competences and then contextual competence—which is interesting in view of the fact that the original weighting of competences in the IPMA's EOC was based on the intuitive impression of its authors (according to our conversation with one of the authors, Gerrit C. L. Koch, at the IPMA Congress in Shanghai in October 2006).

In general, the IPMA EOC can be used as a tool to provide a holistic impression of project management. For those, however, who like to play with more specific categorization, the 18-category view, based on the work of Crawford and her coworkers, might give a somewhat more detailed notion. The measurement tool provided in our study, however, might benefit from some improvements with respect not only to mirroring our sources in the numbers and description of Crawford's categories, but also to the Leadership–Craftsmanship and the Vertical Strategy–Execution dimensions that were used to place the categories within the radar diagram in the first place.

Competence Areas	Journal Papers	MPM Programs	Textbooks
Technical	48%	49%	57%
Behavioral	26%	24%	21%
Contextual	25%	26%	22%

Table 2: Relative focus of journal papers, MPM programs, and textbooks in the competence areas of the IPMA 3.0 competence baseline.

Conclusion

The combined view of project management in Figure 6 indicates that there is a stronger focus on "leadership" than "craftsmanship" and a somewhat stronger focus on "execution" than "strategy." The "leadership–execution" section of the radar diagram is, therefore, strong. This may support the general impression that many organizations do better in defining their objectives and strategy than in actually executing them in a proficient and effective way. A renewed focus on traditional project management themes in the "craftsmanship" section could assist in adjusting this balance.

There is an overall consistency between the essential focal views of project management represented in Figures 3 through 5, and this can clearly be seen in the combined illustration shown in Figure 6. Journals have the strongest focus on resource management, interpersonal competence, and strategic alignment, and MPM programs show a very similar focus, although with the three strongest categories being interpersonal competence,

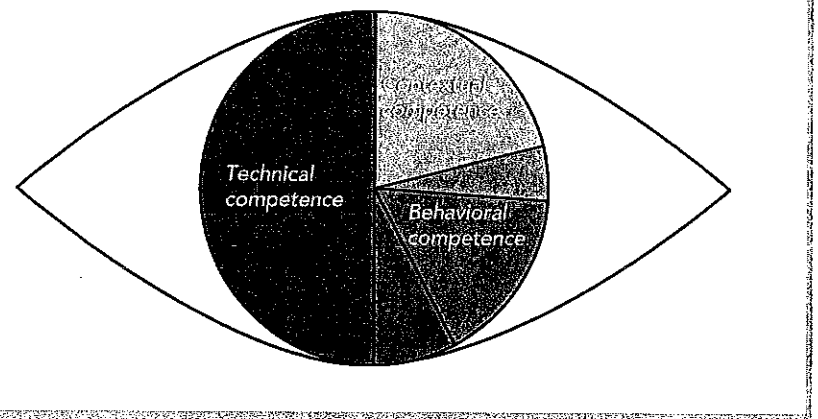

Figure 7: Overview of project management, based on the Eye of Competence.

project planning, and control and strategic alignment. The two strongest categories of textbooks are project planning and control and relationship management, and the third most focused-on category is resource management. It is reasonable to assume that there is a certain time lag between the three sources considered in this study. The journals represent active research in the discipline that is often connected with universities and disseminated to business through the Master of Project Management programs. The time lapse before research results are incorporated into project management textbooks is likely to be longer. Naturally, traditional project management themes will continue to be strongly emphasized in MPM programs and textbooks, regardless of research and development on new frontiers. But given the strong focus in both journals and MPM programs on strategic alignment and interpersonal competence, these will very likely be more visible themes in the project management textbooks in the future.

In view of the strong trends identified in the data studied, we conclude that the traditional baseline used to describe the discipline of project management could be improved. The IPMA's recent EOC and the *Competencies in Project Management, National Competence Baseline for Scandinavia* (Fangel, 2005) represent a step in this direction. Further development of the 360° radar diagram presented in this article may also be of use. Such developments, however, would necessarily involve not only a review of the categories used, but also a more sophisticated analysis—both of the dimensions that were defined for this study and of their links to the categories within the radar diagram. This is an interesting subject for further research aimed at getting a still-clearer picture of the current eye-opening undertakings of the project management field.

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