Abstract

Title: Measuring the Impact of Training in the Implementation of Project Management Information Systems.

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Organizations can use training to maximize the benefits realized through the implementation of project, program, and portfolio management software. However, the relationship between Project Management Information System (PMIS) training and the creation of organizational value is not well understood. The goal of the research is to create a better understanding of current industry project management software training practices and outcomes. This research investigates training utilization and outcomes in the PMIS industry, the prevalence, relative effectiveness and efficiency of several

commonly used training delivery methods at increasing PMIS outcomes, and the relationships of individual and organizational characteristics on outcomes.

An expansive multi-disciplinary review of existing scholarly literature was undertaken to develop a framework for the measurement of project management software training outcomes. Expert input from a panel of 9 practitioners averaging 16.7 years of professional experience related to PM, and 15.1 years of years of professional experience related to PM software usage was used to objectively select a small number of the best-scoring elements of the proposed framework for inclusion in a survey to be administered to practitioners.

In total, 1,021 completed surveys were collected and analyzed using statistical methods. Research findings suggest statistically significant differences in consumption rates, effectiveness and efficiency among the examined training delivery methods. This research may contribute to training that is more effective and more efficient, based on the unique requirements of each individual and organization, at a reasonable cost. The methodologies and findings of this research have immediate implications in improving the planning, delivery, and measurement of PMIS training.

MEASURING THE IMPACT OF TRAINING IN THE IMPLEMENTATION OF PROJECT MANAGEMENT INFORMATION SYSTEMS

By

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PREFACE

Every year, studies report on the number of projects that fail to meet objectives. Contemporary companies and organizations spend millions each year on implementing project management software to gain better control of projects. However the managers, employees, and other stakeholders who have direct interaction with organizational project management systems and data often lack the knowledge, software-specific skills, or buy-in to maximize the value to the organization made available by the project management system. The effectiveness of a PMIS may be hindered by lack of stakeholder buy-in or full understanding of the benefits of the tool, lack of stakeholder understanding of how to use the tool, how the tool interfaces with the business processes of the organization, how to use data outputs to actively manage projects and programs (Deltek, 2009). In addition, it is theorized that stakeholder resistance to change may also reduce the benefits provided by the PMIS. Indeed, stakeholders who do not understand the role of the PMIS may view the PMIS as unnecessary or a waste of time.

By implementing employee and end-user training programs, organizations can increase stakeholder awareness about the PMIS, increase each employee's skill level with the software utilized, and provide valuable information regarding how each employee can use the tool to help them do their job better. By increasing awareness and improving skills, organizations should expect to see increased use of the tools, decreased resistance to adopting the tool, increased adoption of more features provided by the tool, and

increased speed to implementation. These benefits can provide both tangible and intangible value to organizations.

The results of this research will be of particular interest to researchers, consultants, and those considering initiating or continuing investment in Project Management Information Systems (PMIS). This dissertation attempts to provide decision support information oriented toward the realization of maximum value from PMIS implementation. The conclusions of this dissertation, as well as the methodologies employed to generate those conclusions can be used to plan PMIS training programs and generate budgets for PMIS training.

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CHAPTER 1: INTRODUCTION

1.1 Background

Beginning in the second half of the twentieth century, organizations began to use specialized project management software to better plan, execute, and track projects. Much research has been published that explores the extent to which training improves knowledge and performance (Nelson & Cheney, 1987; Eduardo Salas & Cannon-Bowers, 2001; Tannenbaum & Yukl, 1992). There is also a significant amount of literature that evaluates the relative effectiveness of various training delivery methods (Coppola & Myre, 2002; Russell, 2001; Sitzmann, Kraiger, Stewart, & Wisher, 2006; Strother, 2002; Yong-Kean & Teck-Hong, 2010). Methodologies exist that have been used to extensively evaluate the qualitative and quantitative value of training delivered within a corporate or organizational environment (Kirkpatrick & Kirkpatrick, 2006; J. Phillips, 2003; J. Phillips & Stone, 2002; P. Phillips & Phillips, 2007; Westcott-Abudi, 2008).

At this point in time, however, there is no literature that explores the value of training within the context of the implementation of a project, program, and/or portfolio management information system. As the project management software industry continues to mature, commercially available project management toolsets are moving away from the management of singular projects, and are moving toward managing projects and programs together in a unified, enterprise or organization-wide toolset (Kastel, 2009).

Organizations can implement training to encourage the successful implementation of a PMIS, to facilitate or accelerate the implementation of a PMIS so that the organization realizes increased value from a PMIS faster, or to more effectively maximize results. Organizational leadership needs to understand their portfolio of project and program investments. Current economic conditions have only intensified this need. Managing a portfolio of project and program investments requires detailed and up-to-date visibility into each project. As contracting budgets accompany a need for greater business value, executive teams are embracing PMIS for the visibility they need to make project decisions (Symons, 2009).

However, the effectiveness of a PMIS may be hindered by lack of stakeholder understanding of how to use the PMIS or why they should use the PMIS. Indeed, stakeholders who do not understand the role of the PMIS may view the PMIS as unnecessary or a waste of time. Lack of stakeholder knowledge or buy-in can be remedied through training efforts. The purpose of this dissertation is to examine effective training in implementing an effective Project Management Information System (PMIS).

There is no data currently available that quantifies the amount spent annually on project management software training. However, the American Society for Training and Development (ASTD) estimates that U.S. organizations invested $125.88 billion in employee learning and development in 2009. Of the $125.88 billon, ASTD estimates that $78.6 billion was invested in the internal learning function. This includes salaries for

internal staff and expenditures for internally developed training. The remaining $47.3 billion was spent on external services including workshops, external events and vendor services (ASTD, 2010).

1.2 Definition of Project Management Information System (PMIS)

The definition of PMIS utilized throughout this research is as follows: **"Project/program/portfolio management software and any supporting software or systems."** Since without rules that govern human input into the PMIS tools, the data output provided by all project management software would be low quality at best, the definition of PMIS encompasses the organizational policies, workflows, and business processes that govern how the project and program management software is utilized. To improve planning and control of projects, a System Development Life Cycle (SDLC) can be used in conjunction with the Project Management methodology and PMIS (Mitchell, 2006; Morien, 2005). The SDLC defines the tasks that must be executed to successfully develop the system, and serves as a guide that is followed by the project team throughout the system development (Ward, 1994).

In the following, "stakeholder" is defined as any person or group of people who could have an effect on the effectiveness of a scheduling tool or PMIS implementation. Stakeholders include project managers, program managers, organizational executives, engineers and other project resources, sponsors, and consultants.

One of the primary goals of this research project has been to generate outcomes that are meaningful to the entire community of organizations that implement PMIS software, in spite of unique individual and organizational characteristics such as toolset sophistication or capabilities, specific PM software packages in use, industry, or varying numbers of large and small projects.

Project, program, and portfolio management software and systems are used by organizations that constitute a broad range of project types and industrial concentrations. This research seeks to generate findings that are generalizable to a large number of organizations with varying levels of project management toolset sophistication. Since project, program, and portfolio management software tools are often directly linked to, or are used in close conjunction with, other business systems (i.e. accounting systems), this research focuses on benefits created by project/program/portfolio management software and any supporting software or systems.

For small organizations with relatively small projects (less than 1,000 activities), and no existing project management infrastructure, a PMIS may consist of several copies of desktop project scheduling software with project data saved locally on each user's computer. For larger project-based organizations or on large programs, a PMIS may consist of a mix of desktop project management software, server based software, and web-based project management tools. The PMIS may offer integrated risk management capability, portfolio planning and management capability, workflow management,

centralized document storage, sophisticated reporting capabilities, and advanced team collaboration capabilities. A PMIS may be directly integrated with organizational accounting systems, enterprise resource planning systems, timekeeping systems, electronic communications systems (for example: email or sms text messaging), material management systems, logistics systems, supply chain systems, or other business systems. Such systems could range from Primavera P6, linked to portfolio management, accounting, and materials management systems in a large organization that manages complex projects and programs, all the way down to standalone copies of Microsoft Project and Excel within a small organization with a limited number of projects.

This research does not differentiate between client-server, standalone/desktop, or cloud-based toolsets. This decision was made for several reasons. First, non-technical respondents may not be able to answer correctly. Second, one toolset can be deployed in multiple configurations, making correctly answering even more difficult. Third, in the interest of keeping the survey short, non-training related questions have been minimized.

The goal of this research is to generate findings that will be generalizable to a large number of organizations with varying levels of project management toolset sophistication, regardless of factors such as specific software packages used, etc. The intention of this research is to focus on whatever software is actually being used to manage projects, programs, and/or portfolios. Therefore, this research targets specifically project/program/portfolio management software and any supporting software or systems.

1.3 Problem Statement

Organizations face serious challenges in planning, executing, and controlling projects so that project objectives are satisfied. In 2008, the Office of Management and Budget (OMB) and federal agencies identified approximately 413 IT projects, expected to result in at least $25.2 billion in expenditures in FY 2008, as being poorly planned, poorly performing, or both. Lack of effective project planning, management, and oversight were identified as principal reasons for the poor project performance (GAO, 2008). A study conducted by IBM in 2008 found that only 41% of change management projects were successful in meeting time, budget, and quality constraints, 44% of projects were unsuccessful at meeting at least one time, budget, or quality goal, and 15% missed all goals or were canceled by management. Over 1,500 project managers, project sponsors, change managers, and project leaders were surveyed and interviewed for the study (IBM, 2008a). The Standish Group reported that in 2010, that only 37% of all examined IT projects were successful, while 42% were challenged, and 21% failed (Cable, 2011).

There is currently a strong desire among organizations that are involved in projects and project management to improve project performance and outcomes. Evidence of this interest can be observed in the growing number of professional certifications in project management being bestowed upon practitioners, and in the expanding membership in professional organizations dedicated to project management. The number of Project Management Professional (PMP) credential holders grew by 14% in 2009 from 318,000 in 2008 to 360,000 in 2009. Holders of the Certified Associate in Project Management

(CAPM) grew by 53% in 2009, and membership in the Project Management Institute (PMI) grew by 7%. (Project Management Institute., 2009).

As cited by Raymond & Bergeron (2008), "Gartner Research estimates that 75% of large IT projects managed with the support of a project management information system (PMIS) will succeed, while 75% of projects without such support will fail."

However, the full potential positive impact of the implementation of PM software and toolsets can be hindered by the following:

- Lack of stakeholder buy-in or understanding of the benefits of the tool;
- Lack of stakeholder understanding of how to use the tool;
- Lack of understanding how the tool interfaces with the business processes of the organization;
- Lack of understanding of how to use data outputs to actively manage projects and programs (Deltek, 2009);
- Lack of understanding of the benefits offered to the stakeholder by the PMIS; and
- Stakeholder resistance to change.

The implementation of project and program management software can be improved through effective employee and end-user training. By increasing stakeholder awareness surrounding PMIS, organizations can expect to see increased use of the toolset, decreased resistance to adopting the toolset, increased adoption of more features provided by the

tool, and increased speed to implementation. These benefits can provide both tangible and intangible value to organizations.

Because each organization is different, there is no "one size fits all" PMIS. Similarly, each group of stakeholders will have different training requirements. Recent research suggests that there is no single correct way to do project management (Sauser, Reilly, & Shenhar, 2009; A. Shenhar et al., 2005; A. J. Shenhar, 2001; J. Thomas & Mullaly, 2008). The appropriate way depends on the context of the organization, the types of projects in which the organization is involved, the culture within the organization itself, the national environment in which the projects are performed, and the novelty, complexity, technology and pace of the project. Different organizations which implement a PMIS will benefit differently from various capabilities provided by a PMIS. It would be immensely helpful for organizations to understand what works in organizations and projects like theirs, and how they can adapt their practices to leverage value from what they already know works.

This dissertation seeks to survey the implementation of project management information system training in real-world organizations and explore the relationship between employee training delivered and training outcomes. The dissertation then seeks to determine the most effective industry-specific training techniques for increasing individual user proficiency and organizational value provided by a PMIS according to actual users. For example, do users report that live instructor-led classroom training

provides more value than live instructor-led virtual (online) training? The relationship between training type, training hours, and actual costs, is explored to see which training techniques are most efficient at increasing training outcomes. Finally a regression-based approach is used to generate a model to determine the appropriate amount to pay for training.

1.4 Research Objectives

The objective of this dissertation is to create a document that will allow a project manager, executive, or client organization to evaluate and plan PMIS training. The same project manager, executive, or client organization will also be able to use the key PMIS value metrics proposed in this dissertation to evaluate the goals and content of their PMIS training. The practitioner survey utilized as the primary means of data collection will provide valuable data that will show what training delivery methods are currently in use. The research to be performed regarding the effectiveness and efficiency of various types of training (i.e. classroom style training, one-on-one mentoring, etc.) can be leveraged to provide a better understanding of which types of PMIS training will be best for an organization. Using the results of the survey data, an analysis will be performed that will help answer the question of how much is the appropriate amount to pay for PMIS training, or whether an organization has paid too much for PMIS training.

1.5 Importance of Research

To date, there has been no academic research that rigorously addresses PMIS training. This research is fundamentally important in that at the present time, organizations have no way to objectively evaluate the best training options for their organization or to objectively evaluate the fair value for training based on the unique PMIS goals of the organization, the current proficiency levels of the employees, or the current options for training delivery methods. Practitioners also have no way of knowing how hours spent in training translate to self-reported improved proficiency with the toolset and organizational value created.

1.6 Organization of Dissertation

This dissertation is organized in six chapters. The background and purpose for the research are explained in Chapter 1. The first chapter presents the problem statement, the objectives of the research, the importance of the research, and the organization of the dissertation. Chapter 2 contains a thorough literature review. An overview of the history of PMIS, the capabilities of modern systems, the cost model of a typical PMIS investment is presented, major toolset vendors are identified, past research into the value of project management, and obstacles to PMIS value return are all presented in the second chapter. Chapter 3 presents the research questions to be addressed by this dissertation, describes the importance of each research question, explains the data necessary to answer each question, and provides the methodologies to be used to answer

each research question. Chapter 4 describes the tasks that must be accomplished to complete this research, gives an approximate sequence of the tasks, and provides a timeline for the research. Chapter 5 explains the expected findings of the research based on current literature. Chapter 6 provides conclusions and recommendations.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview of Project, Program, and Portfolio Management Toolsets

2.1.1 PMIS Historical Review

The Program Evaluation and Review Technique (PERT) and the Critical Path Method (CPM) were developed simultaneously in the late 1950's. PERT was developed by the U.S. Navy, Booz Allen Hamilton, and Lockheed Aircraft while CPM was developed by Dupont De Nemours Inc. When PERT and CPM were developed, there were significant differences between the two techniques. PERT used probabilistic estimates of activity durations, while CPM used deterministic estimates. Both techniques used time and cost estimates to allow time/cost tradeoffs to be examined. In addition, both techniques used networks to display task sequences. PERT and CPM both identified a critical path of tasks that could not be delayed without delaying the completion of the project, and both identified activities with slack that could be delayed without delaying the project finish date (Mantel, 2005). Since the inception of PERT and CPM in the late 1950's, the underlying principles of network scheduling have undergone a transformation from being applied only to the largest government and corporate programs, to becoming widespread and available for use by virtually anyone with a personal computer and scheduling software (C. C. Smith, 2008, p. 110).

The development of the personal computer in the 1980's dramatically accelerated the widespread adoption of project management software (Liberatore & Pollack-Johnson, 2003). Today, the use of specialized software and systems to enhance the management of

projects, programs, and portfolios is widespread (Rapport, 2009). The number of PM-oriented software packages available to practitioners is extensive, and contemporary companies and organizations are making significant financial investments in project management software. Spending on project management software can be seen in the proliferation of project management software into myriad industries. Forrester notes that project management software is now used in the accounting and auditing services industries, advertising and public relations services, architectural and engineering services, construction services, financial services, consulting, and high-tech software and hardware industries as cited by the American Council of Engineering Companies of Minnesota Chapter Monthly Meeting by Systems Consulting Group (American Council of Engineering Companies of Minnesota, 2008). As cited by Waxer (2009), Forrester Research estimated the value of the market for project management software in 2009 at $4.25 billion, and predicted that spending for project management software would increase to $6.5 billion in 2010.

As the project management software industry has matured, the primary focus has shifted away from the management of singular projects toward the management of multiple projects, programs, and portfolios across the entire organization (Kastel, 2009). Recent literature and iterations of PM software released by vendors suggest a strong positive relationship between increased levels of integration with other business systems and data, and the benefits offered by PM tools (Callaghan, 2003; Kastel, 2009).

Consequently, the software and processes actually used to manage projects, programs, and/or portfolios within each organization are unique, and despite widespread popularity within project-focused organizations, at present time there is no academic or industry standard definition of Project Management Information System (PMIS).

Levine characterizes PMIS as simply the management of multiple projects (2005). Kastel defines PMIS as "The discipline of performing difficult, complicated, complex, or risky projects in business organizations" (2009, p. 294). In the book Winning in Business with Enterprise Project Management, Dinsmore defines Enterprise Project Management as an "organization-wide managerial philosophy based on the principle that company goals are achievable through a web of simultaneous projects, which calls for a systemic approach and includes corporate strategy projects, operational improvement, and organizational transformation, as well as traditional development projects" (Dinsmore, 1999, p. 18). Enterprise Project Management represents a shift in philosophy from accomplishing single projects in traditional functional silos towards accomplishing projects across the organization (Dinsmore, 1999; Dinsmore & Cabanis-Brewin, 2006; Kastel, 2009; Levine, 2005). In the same way there is no agreement about the definition of PMIS, there is no agreement about what characterizes a PMIS. Software vendors advertise based on the capabilities of their products.

Kastel characterizes the maturity of a PMIS in terms of integration across business systems. For example, a low maturity level PMIS would limited to integrated project and

program schedules integrated with an ERP system. A medium maturity PMIS would have linked project and program schedules integrated with the organizational ERP system and accounting data. And a high maturity level PMIS would have project and program schedules integrated with accounting data, bidding data, materials planning, ERP, (Kastel, 2009, pp. 48-50).

Liberatore & Pollack-Johnson (2003, p. 168) found that 51% of survey respondents used project management software for all of their projects. In addition, it was found that 95% of respondents use project management software for planning while 80% use project management software for both planning and project control. Whether respondents use PM software for only planning, or for both planning and control appears to be influenced individually by the number of activities in a typical project, firm size, extent of PM software usage, and by the percentage of work performed in project management.

2.1.2 Current PMIS Capabilities

Recent progress in information technology has greatly increased the capabilities and functionality provided by project management toolsets. An organization's local area network or intranet and the internet can be used to transmit any information that the organization decides to, including status of a particular activity, resource and cost data for an activity, progress-to-date on a project and expense-to-date for a project. Project stakeholders can use the internet to communicate and report on project status, regardless

of whether stakeholders are in the same office or across the world. Project team members can provide updated status for their sections of a project plan from an offsite location, without the need for a local copy of the organization's project management software. Secure web pages can be created to collect, store, and disseminate information on projects. Valuable real-time reports can be generated without time-consuming phone conversations or on-site meetings. In addition, reports can be customized for their intended audiences. Consequently, virtual teams can be created, with members contributing to project efforts while spread out perhaps across continents. Web pages can be set up to communicate project information to and from various clients, other web pages can be maintained for use by project team members, while yet other web pages are can be designed for use exclusively by an organization's executive management (Mantel, 2005). Improvements in collaboration software enhance teamwork by allowing users to secure and organize shared project data through version control and check-in / check-out (Callaghan, 2003). Project management software is being used to manage both internal projects and projects for clients (Rapport, 2009).

Project management information systems are being integrated with other business systems in the organization so that information propagates through the systems almost instantaneously and does not have to be manually re-entered into each system. Project management information systems are being integrated with design tools, materials management systems, and accounting systems. Project team members who work in the

field can provide daily status updates remotely so that schedules for upcoming work can be adjusted. In addition, the software can be used for benchmarking activity characteristics to improve estimates for future work. For example, if a certain type of activity consistently takes longer than anticipated, the software can be set to automatically extend the planned duration of future activities of that nature (Lawton, 2000). Integration with communications systems allows off-site team members to provide updated data to the PMIS using ubiquitous software, like email applications, instead of expensive desktop project management software (Callaghan, 2003). Furthermore, project management software creators are making project management software easier for partners and clients to integrate with other business tools (Callaghan, 2003).

Project management information systems save organizations time and promote effective management by simplifying complex tasks like the tracking of project progress, identification and elimination of problems, and the propagation of important project information. Project management information systems allow users detailed insight into resource allocation, work, and cost with respect to time since scope, resources, schedule, and budget can be consolidated into one place. Project management information systems also offer the ability to benchmark project performance, where a copy of the original plan is saved, along with adjusted plans as the project is executed. Stored project information can be used to document findings. Notes about tasks and resources can be stored for future reference when analyzing problems and performance. Project management

information systems allow teams to plan and control project work with a centralized understanding of process and performance, enabling trend forecasting, management by exception through the isolation of problems, and calculation of estimated time and cost to completion. The ability to collaborate throughout the enterprise can improve productivity and efficiency across teams and departments. In addition, off-site workers can be remotely notified of job assignments. Time collection from field-personnel can be automated. Project management information systems enable communication and enhanced resource planning beyond the singular project. This can prevent the over-allocation of project resources, which can cause confusion, frustration, reduced quality, significant inefficiencies, and missed commitments (J. Smith, 2002, June).

Project Management Information Systems can also provide capabilities such as estimation and planning capabilities, what-if analysis, workflow modeling, pipeline analysis, resource management, document management, and contract management. Storing all project data in a central location gives stakeholders immediate access to current project information. The presence of a centralized project record creates an immediate streamlining effect on project communications and efficiency. Project Management Information Systems allow organizations to plan, create, and optimize automated workflows that dictate the flow of work throughout the organization. The presence of clearly defined an transparent workflows allows employees to prepare for

work as it is coming to them, and employees who do not act on work as it comes to them can be quickly identified (Setzer & Bonafair, 2004).

Project management software allows users to plan, organize, and manage resource pools and develop estimates for resource requirements. Resource breakdown structures, the availability of various resources, resource rates, and multiple resource calendars can be managed to assist in the optimization of resource usage. To plan activity durations, the amount of estimated work required to complete an activity and the anticipated resources to be applied to the activity are used to calculate the number of work periods (planned activity duration) necessary to complete the activity. Project calendars and calendars for individual resources or resource groups are combined with activity duration estimates and task sequencing to create planned start and planned finish dates for each activity and project. In addition, a PMIS facilitates the establishment of project baselines, tracking of planned dates versus actual dates, forecasting the effects of project changes on project schedules. Cost estimating applications, simulation, statistical tools can be used to rapidly generate cost estimates and can simplify the use of cost estimating techniques and can facilitate the rapid generation of cost estimate alternatives and cost-schedule trade-off. The use of a PMIS to calculate schedule float and project performance metrics such as Schedule Variance (SV), Schedule Performance Index (SPI), and Cost Performance Index (CPI) can provide insight into performance problems and can be used to justify corrective or preventive action. Trend analysis can be used to forecast a range of final

project outcomes. The reporting capabilities of most PMIS software allows the generation of detailed or graphical reports (Project Management Institute., 2008a).

Senior management may not want users from other business units, functional areas, or partner organizations to have the same level of detailed access to project information as the users performing and managing the work. Contemporary project management information systems offer the capability to limit the amount of information available to users who do not need or are not permitted access to specific information, while providing access to detailed information to users who require access (Mantel, 2005).

2.1.3 PMIS Industry Overview

The construction industry has strongly adopted project management software. Various project management software packages now earn the endorsement of general contractors and owners on large projects that include universities and major school systems. Private owners and agencies like the U.S. General Services Administration are also realizing value as users of project management information systems. General contractors and construction managers are contractually requiring subcontractors to use specific project management software (Setzer & Bonafair, 2004). As of 2006, insurance company Aflac reported using Primavera project management software to manage projects for almost 5 years, and the Ministry of Labour and Citizens' Services in Canada's British Columbia province were using Microsoft project management software (Bednarz & Dubie, 2006).

The Clark Construction Group, Inc. headquartered in Bethesda Maryland, ranked by Engineering News Record as the eleventh largest general contractor in the United States, with annual revenue of $4.8 billion in 2009 (Clark Construction Group, LLC - Corporate Overview, 2011) adopted a hosted internet-based project management system in 2001 and introduced it to subcontractors in small increments. As of 2004, the system had proven so valuable that all subcontractors were required to use it (Setzer & Bonafair, 2004).

Forrester Research identifies the costs necessary to implement a PMIS in the categories of hardware, software, implementation, support, enhancement (Symons, 2009). The cost structure varies depending on the nature of the implementation. In the case of on-premise deployments, organizations see high initial software costs upfront, followed by relatively lower support costs. Project management software can also be deployed using a Software as a Service (SaaS) procurement strategy. Organizations that elect to deploy a PMIS using a SaaS model will experience lower costs for hardware and support, but the software costs will exist throughout the entire duration of the PMIS use. The cost elements identified by Forrester Research are as follows:

Hardware costs include the cost of all hardware required to run the necessary software, including additional IT acquisitions necessary to host the PMIS, license and maintenance fees. SaaS deployments generally do not have hardware costs. Hardware costs for on-premise deployments vary because vendors require different levels of hardware

investment. Some organizations may repurpose existing hardware to control this cost (Symons, 2009).

Software costs vary between vendors depending on the licensing structure employed by each vendor. Project management information systems can be hosted externally to the organization, or internally. The difference to the implementing customer in terms of implementation and cost structure are significant (Setzer & Bonafair, 2004).

Software costs may include the cost for a basic level of project management functionality, costs for individual software modules, various types of user licenses, monthly subscription fees, and possible maintenance fees (Symons, 2009).

Implementation costs can come from both the software vendor and the implementing organization. There will be an internal cost for the effort necessary to plan and manage the goals of the organization and the implementation itself, and to design the configuration of the toolset to match these goals. Vendors can provide consultants to assist with or manage the implementation, or design the toolset configuration based on the requirements of the implementing organization. Vendor costs can also include toolset configuration, testing, and training as well (Symons, 2009).

Support costs represent the cost of maintaining the PMIS and the cost of managing the infrastructure supporting the tools (Symons, 2009). Enhancement costs are the costs necessary for further development of the tool and its users after the initial implementation of the PMIS. This includes the time and effort to manage the rollout of major upgrades,

as well as the usage of additional vendor services such as training and development sessions (Symons, 2009). Although not explicitly stated in the Forrester paper, training costs would be incurred within the implementation, support, or enhancement cost categories. The category would depend on the purpose of the training.

Major PMIS Software Vendors

Vendors: This section contains vendors and software tools that are intended to be deployed in a project management capacity as part of an organizational enterprise project management solution. The number of project management software tools available to practitioners today is extensive and the table below is not exhaustive. Tools that are not specifically intended to be deployed as part of a project management solution have not been included. For example, although it is possible to perform basic scheduling functions in general spreadsheet software instead of with a specialized scheduling tool, general spreadsheet applications are not listed.

Table 1: Project Management Information System Software Vendors

Vendor	PMIS Product	Vendor Website
Artemis	Artemis 7	www.aisc.com/
	Artemis 9000	www.aisc.com/
	Artemis Views	www.aisc.com/
AtTask	AtTask PPM	http://www.attask.com
CA	Clarity PPM	www.ca.com
Clarizen	Clarizen Work Management Enterprise	www.clarizen.com/
Comindwork	Comindwork 2.3	www.comindwork.com
Compuware	Changepoint	www.compuware.com
Daptiv	Daptiv PPM	http://www.daptiv.com/
Deltek	Open Plan	www.deltek.com/
Designtech	ProjectCoordinatorX	www.designtech.se
GenSight	Gensight PPM	www.gensight.com
HP	HP Project and Portfolio Management Center	www.hp.com
IBM	IBM Rational Project Management Software	www.ibm.com
Lawson Software	Lawson M3 Project Management	www.lawson.com
Matchware Inc.	MindView 3 Business	www.matchware.com
Metafuse	Project Insight	www.projectinsight.net
Methodware	Enterprise Risk Assessor 7.1	www.methodware.com
Métier	WorkLenz	www.metier.com
Microsoft	Microsoft Project	www.microsoft.com
	Project Server	www.microsoft.com
	Project Portfolio Server	www.microsoft.com
Oracle	PeopleSoft Enterprise	www.oracle.com
	E-Business Suite Projects	www.oracle.com
	Primavera P6	www.oracle.com
Planisware	Planisware 5	www.planisware.com
Planview	Planview Enterprise	www.planview.com
PMO Advisors LLC	PMO Advisor v2.1	www.pmoadvisors.com
PowerSteering	PowerSteering	www.powersteeringsoftware.com
SAP	cProjects/RPM	www.sap.com
	(merged to form) SAP Portfolio and Project Management	
Scitor	Project Scheduler	
Serena Software	Mariner 2009	www.serena.com
UDA Technologies	ConstructionOnline	www.uniteddesign.com

Data in the above table from (Bednarz & Dubie, 2006; Ciftci, 2007; Fabac, Radosevic, & Pihir, 2010; Product Round Up, 2010; Visitacion & DeGennaro, 2009).

Consultancies: Because the use of project and program management software has become so ubiquitous, there are a large number of companies and organizations that specialize in the deployment and support of Project Management Information Systems.

2.1.4 The Value of a PMIS

At this time, there is no literature that attempts to quantify the organizational value provided by a PMIS. However, there are a number of resources that extol the benefits of a properly implemented PMIS. However, metrics to measure the impact or value of a PMIS can be extrapolated from the benefits an organization can expect to see.

As cited by Bednarz & Dubie (2006), a survey by KPMG International found that 81% of polled companies reported an increase in the number of new IT projects in the previous 12 months. 88% reported an escalation in the complexity of projects. Out of the 600 organizations included in the survey, 79% reported increasing total project budget. Nearly half of all respondents had at least one project fail to meet objectives in the past year, while 86% of the companies experienced losses of as much as 25% of targeted benefits across their project portfolios. KPMG observed that companies squander potential benefits of their IT projects due to the fact that projects are not managed well enough throughout the project lifecycle.

Raymond & Bergeron (2008) found that using a PMIS to manage projects increases the productivity, effectiveness and efficiency of project managers in making decisions.

Project and portfolio management software can be used to better plan and track projects by helping organizations to manage schedules, special skills, availability, budgets, and project milestones. Having a project management information system with governance capabilities already deployed can streamline regulatory compliance. Having project governance in place makes external audits go smoother for initiatives such as Sarbanes-Oxley (Bednarz & Dubie, 2006).

Modern enterprise project management software provides the visibility and functionality necessary for organizations to ensure that projects have adequate and proper resources, are effectively sequenced, can be successfully tracked and managed, are strategically aligned with organizational objectives, are properly estimated, and are achievable. Forrester Research has found that organizations that implement a PMIS see may project failure rates decrease by approximately 15% (Symons, 2009). Failed projects result in lack of organizational focus, wasted money, and lost opportunity (IBM, 2008a).

The implementation of a PMIS has also been shown to provide organizational value through reduced project cost overruns. Although cost overruns may cause a project or program to fail, even projects and programs that provide a positive return may exceed their budgets because of inferior scheduling, poor budget estimates, and lack of transparency. The enhanced change management, issue management, and resource scheduling capabilities provided by a PMIS assist management in keeping projects within

budgetary constraints. Forrester Research found that the implementation of a PMIS decreased the rate of cost overruns by approximately 10% (Symons, 2009).

PMIS have been shown to produce value by reducing project throughput times, where project throughput time is defined as the average time it takes to complete a project. The workflow capabilities of a PMIS keep work moving, resource planning and management capabilities enable management to ensure that project resources have the proper skills and that projects are aligned with organizational resource availability, while reporting capabilities provide management with insight that enables quick decisions. Consequently, organizations experience reduced project duration, which allows resources to spend more time performing other value-adding activities. When the project is revenue-generating, reduced duration will lead to swifter access to that revenue. PMIS customers contacted by Forrester Research estimated that their project durations decreased by approximately 10% following the implementation of the PMIS (Symons, 2009).

The portfolio management and planning capabilities offered by a PMIS allow organizations to score and prioritize potential projects, reducing the number of low-value projects undertaken by organization (Rapport, 2009; Symons, 2009). Low-value projects are poorly aligned with organizational strategy or share redundant goals with other projects, and thus diminish the value of the overall portfolio. PMIS provide program and portfolio management features and capabilities such as business cases and standardized project scorecards that assist management in undertaking only the best projects for the

organization. In addition, PMIS can be used to track status, risks, issues, changes, and the earned value of ongoing projects and identify the problematic projects. Forrester Research has found that organizations that utilize a PMIS for program and portfolio planning identify about 10% of projects as low-value or redundant (Symons, 2009).

PMIS can reduce the amount of administrative time that managers spend gathering project status data and generating reports manually. Since a PMIS can store all data in a central location, report generating tools can instantaneously capture this data and generate reports. Because managers are not spending time manually collecting and assimilating data and producing reports, they have more time to devote to other value-adding activities. Companies contacted by Forrester Research that have implemented a PMIS estimate that managerial administrative time decreased by approximately 10% (Symons, 2009). As projects are planned and managed using a PMIS, project templates based on current and past projects can be stored, which reduces the amount of planning effort required when a similar project is undertaken by the organization (Rapport, 2009).

Project management software also serves to enforce accountability on project teams. As task lists are generated, resources can be assigned to each task, which helps eliminate confusion about who is responsible for which activities (Rapport, 2009).

It should be noted that different project management toolsets may offer diverse benefits and varying levels of value to implementing organizations due to differences in features and functionality. For example, a study by Kastor and Sirakoulis in 2009 found that

Primavera P6 outperformed Microsoft Project and Open Workbench at producing optimized resource leveling solutions (Kastor & Sirakoulis, 2009).

Kastel states that organizations that successfully implement a PMIS where project and program management software is integrated with other business systems are likely to see performance improvement through decreased costs and through performance improvements. Organizations are likely to save money through the elimination of double and triple entries of data and reconciliation efforts, reduction of IT support requirements due to a reduction in total number of systems needed, elimination of interfaces, reduced training requirements because of the reduction of multiple redundant systems, and standardization of terminology. Organizations can also expect to see reduced procurement costs, make better decisions, and streamline operations. The more comprehensive and nearly instantaneous flow of data enabled by a PMIS tends to lead to an increase in competitiveness, improved decision-making, enhanced planning capabilities, and improved quality of estimates for sales. Readily available historical data allows benchmarking of projects and creates more consistent project outcomes. In addition, having one system of record reduces risk. Kastel posits that the scalability of integrated project and program management software provides the implementing organization the ability to roll-out the system to various departments providing savings through economies of scale. The PMIS can even be rolled out to joint ventures and new organizational acquisitions. (Kastel, 2009).

Kaiser & Ahlemann (2010) suggest that the benefits made available by project management information systems can be grouped into three general categories: individual benefits, workgroup benefits, and organizational benefits. Individual benefits include increased transparency, time saving, and improved utilization of resources, drawing the user's attention to important information, increasing overall control over project management processes, and increasing the user's performance with respect to project management roles. Workgroup benefits include improved communication within the project team, improved meeting efficiency, and improved task delegation and tracking. Organizational benefits consist of the ability to create better products, increased customer satisfaction, improved productivity, reduced time-to-market, increased revenue, and faster and more comprehensive achievement of organizational goals.

2.2 Current Training Literature

2.2.1 Training Use in the Knowledge Economy

Significant research has been published that documents the use of training to improve computer skills and targeted objectives (Nelson & Cheney, 1987; Eduardo Salas & Cannon-Bowers, 2001; Tannenbaum & Yukl, 1992). The use of training in the workplace is prevalent. The American Society for Training and Development (ASTD, 2010) estimates that U.S. organizations invested $125.88 billion in employee learning and development in 2009 (ASTD, 2010).

It has been shown that training activities have a positive impact on the performance of individuals and teams (Aguinis & Kraiger, 2009). Methodologies exist that have been used to extensively evaluate the qualitative and quantitative value of training delivered within a corporate or organizational environment (Kirkpatrick & Kirkpatrick, 2006; J. Phillips, 2003; J. Phillips & Stone, 2002; P. Phillips & Phillips, 2007; Westcott-Abudi, 2008). To our knowledge, however, there is no research at this time that seeks to explore the benefits of training within the context of the PMIS implementation.

The delivery of training to learners is advancing so that content can be delivered repeatedly, instead of only once. According to ASTD, in 2007 e-learning accounted for the delivery of almost one-third of learning content, and is being utilized more frequently. Organizations are taking advantage of technology to deliver learning at reduced cost and to dispersed locations (Paradise, 2008). Many electronically delivered formats such as simulation, instructional games, and social networking sites that were nonexistent a few years ago are now being widely implemented (Paradise, 2008). To meet the growing demand for project management skills in employees, many universities are offering project management courses as either electives or core courses (Pant & Baroudi, 2008).

A table of training techniques currently being used in corporate environments is shown below.

Table 2: Training Delivery Methods Currently in Use

No.	Training Technique	No.	Training Technique
1	Live instructor-led real classroom	11	Job aids
2	Live instructor-led virtual (online) classroom	12	On-the-job learning
3	Live instructor-led remote, but not Online (e.g. Teleconference, Satellite, Video Conference)	13	Job rotation
4	Self-paced online (networked)	14	Tuition-reimbursed education
5	Self-paced stand-alone (non-networked) computer based (e.g. Cd-rom)	15	Employer-supported conference attendance
6	Technology other than computer (e.g. Videotape, audio cd)	16	Employer-supported membership in professional associations
7	Self-paced non-technology (e.g. Book)	17	Simulation
8	Mentoring and coaching	18	Social networking sites
9	Knowledge sharing (e.g., experts on call, communities of practice)	19	Lunch and learn style meetings
10	Knowledge bases (e.g., searchable reference materials)		

Data in the above table from (American Society for Training and Development, 2010; Harris, 1995; Paradise, 2008; Paradise & Patel, 2009; Yong-Kean & Teck-Hong, 2010)

2.2.2 Training in Project Management Information Systems

When managed effectively, knowledge can be used to improve customer satisfaction, reduce project time, and improve the quality of deliverables (Love, Edum-Fotwe, & Irani, 2003). However, empirical studies that have been undertaken to evaluate the actual impact of project management software and explore patterns of its usage are extremely limited (Ali, Anbari, & Money, 2008; Raymond & Bergeron, 2008). Project management has become an important part of the curriculum in the MBA and executive education

programs at many universities, and has become a critical investment for a range of companies in a growing number of industries and sectors (Berggren & Söderlund, 2008).

In a nationwide survey of 1,000 randomly selected PMI members, Fox and Spence asked project managers to report on the project management software they used, amount of use, types of use, satisfaction with the tools, level of training received on the tools, perceived adequacy of training received, and adequacy of the tools use. The survey results indicated that receiving training on the use of a tool raised a user satisfaction with that tool. Additionally, satisfaction with the adequacy of training received was related to increased satisfaction with the tool. Those who had received even minimal training on the use of project management software had a significant impact on project managers' perceived adequacy of training. Furthermore it was found that the number of hours of training received and the perceived adequacy of the training were significantly related and positively correlated (1998).

Saeed Bani Ali, Anbari, and Money found that there was no significant relationship between the level of training and the use of project management software (2008). However a majority of the 497 who were surveyed reported receiving no project management software training, or minimal training consisting of one or two courses. In addition, 80% of those surveyed had been using project management software for more than 4 years. This study also showed that project managers with more years of experience with project management software are more likely to use project management software in

the management of projects, irrespective of how much training each project manager has received.

The Thomas-Mullaly (2008) study did not focus on how organizations implement training in organizations to increase individual competency and organizational value provided by a PMIS, however many of the criterion examined during the study are germane to a study of increasing individual competency and organizational value. Thomas and Mullaly (2008) examined various aspects of project management training offered by the case study organizations in the implementation of project management. The definition of project management was not imposed by the researchers, and was allowed to be defined by each case study organization based on what the organization had implemented to address the management of projects. Thomas and Mullaly examined the topics of the training such as: portfolio management, program management, project management, project delivery, project governance, value realization, resource management, organization integration, team building, risk management, organizational methodologies, government policies and legislation, regulatory guidelines, quality control and leadership. Training delivery methods were also examined. The training delivery methods examined included: instructor led, learner-driven, face-to-face, online, video, webcast, and reading/self-study. In addition, the degree of customization of training was examined. The research also explored who was delivering within each organization including: educational institutions, external consultants, in-house trainers. Informal

training vehicles that were utilized in supporting skills development and knowledge transfer were examined. These vehicles included: conference participation, association participation, internal conferences, lessons learned, lunch and learns, coaching and mentoring, communities of practice, competition participation, review meetings, site visits, and self-learning. The duration of training programs that were delivered in support of organizational project management implementations was also evaluated. Duration was examined in discrete increments. Increments evaluated included: less than one week, one week, two to four weeks, one to six months, and greater than 6 months.

The Thomas-Mullaly study (2008) also examined the software tools used to support the project management implementation. However, the explicit relationship between training and project management software was not documented. The software tools examined included: scheduling software, resource management software, cost management software, risk management software, estimation software, portfolio management software, dashboard reporting software, portal software, collaboration software, and software interfaces. Databases employed to support the capture, management, and dissemination of project management knowledge and information were also examined. Databases examined include: knowledge management systems, expert systems, lessons-learned databases, project archives, and reference sources. Although the Thomas and Mullaly study (2008) did not report on the best ways to implement training in organizations to increase individual competency and organizational value provided by a

PMIS, but many of the components examined in the study can be leveraged to gain insight into how organizations are using PMIS training.

The study (J. Thomas & Mullaly, 2008) also examined motivators for implementation of project management were also examined. Motivators examined included: increasing project complexity, increasing number of projects, time pressure on projects, market pressures, competitive pressures, maintaining appearance of being current, best practices, and globalization. The overall objectives of the organization were documented and included: improving project performance, improving business case realization, accelerating project delivery, project cost reduction, increasing organizational credibility, gaining a competitive advantage, and aligning with partner expectations and commitments.

The Thomas Mullaly study (2008) examined key indicators of improved process outcomes due to the implementation of project management. Because one of the major advantages of implementing a PMIS is the reinforcement of project management business processes, it is reasonable to assume that organizations that implement a PMIS would realize many of the same improvements in business process. Many of the key indicators identified by Thomas and Mullaly were designed to capture the degree to which projects delivered more effectively against their target objectives. These key indicators were: Attainment of scope, attainment of driving priorities, sponsor satisfaction, user satisfaction, and project team satisfaction. Other key indicators were designed to assess

the degree to which the project management implementation enabled better process performance within the organization. These key indicators included: increased efficiency, improved multi-project coordination, better project control, greater project transparency, improved project performance. Several business indicators were also examined that are applicable to an organization implementing a PMIS. The business indicators examined included: Improvement in organizational culture, greater entrepreneurship, greater innovation, more knowledge management/know how, and more effective communication. The Thomas Mullaly study (2008) also examined maturity of project management practices within the studied organizations and the extent to which the project management implementation was expected to continue to deliver value.

The Project Management Institute defines stakeholders as

> "Persons and organizations such as customers, sponsors, the performing organization, and the public that are actively involved in the project, or whose interests may be positively or negatively affected by the execution or completion of the project. They may also exert influence over the project and its deliverable. Stakeholders may be at different levels within the organization and may possess different authority levels, or may be external to the performing organization for the project"
>
> (Project Management Institute., 2008a, p. 246)

The following group of stakeholders is identified by Dinsmore (1999) as those most likely to require training in the implementation of enterprise project management: project managers and key project personnel, directors and top level executives, program managers partners, clients, key vendors, and functional managers and support personnel.

Dinsmore (1999) recommends that small organizations get training from outside sources since small organizations typically lack experience in educational program development and project management. Dinsmore advocates colleges, consultants, and professional organizations as good outside sources for training. Medium sized and large organizations are encouraged to mix and match outside training sources with internal resources. This provides the benefits of external training sources, while allowing internal resources to contribute relevant organization-specific content. There is also the added benefit of internalizing the training content to allow the organization to continue the training program after the outside help has left. For mature organizations that are able to identify their needs and have the necessary resources internally, Dinsmore advocates developing and delivering training using internal resources. Any project management training must be tailored for the needs of the recipients. The following must be considered when developing training content: the organization's strategies and objectives, current degree of project management maturity, urgency of training, previous training received, and training program objectives.

2.2.3 Techniques Currently Used to Quantify the Business Value of Training

There is a sizable body of knowledge of research that attempts to quantify the value of organizational activities in modern organizations. There has been significant writing

about quantifying the value of training programs. Thomas and Mullaly (2007, p. 26) define the current methodologies in terms of three categories:

- Return on Investment (ROI) type approaches
- Balanced Scorecard Metrics approaches
- Organizational competency approaches

Jack J. Philips and Donald L. Kirkpatrick are two often-cited authors in the area of quantifying the value of training (Gekoski, 1999). According to Phillips and Phillips (2007), the two standard formulas for assessing training programs in terms of economic factors are benefit/cost ratio (BCR), and return on investment (ROI). The formulas for each are as follows:

BCR = Program Benefits/Program Costs

ROI (%) = (Net Program Benefits/Program Costs) x 100

Focusing only on the potential financial benefits of training initiatives would lead to an incomplete capture of value, as many of the potential rewards offered by the implementation of training are intangible and thus would be excluded under such an approach. Most training programs will generate intangible benefits for the organization (P. Phillips & Phillips, 2007).

The framework developed by Philips to measure training outcomes utilizes 6 types of data. The six types of data correspond to Philips' five levels of measurement, and

intangible benefits. The Philips model can be used to measure a wide variety of training and educational programs. Examples include organizational change initiatives, performance-improvement programs, and human resource initiatives. The fifth level of the framework is an addition to the four levels of evaluation created by Kirkpatrick (J. Phillips & Stone, 2002). The five levels of data are as follows:

Level 1: Evaluation focuses on learner reaction to the training and the trainer. The planned actions of participants with respect to implementing the new skills or processes presented during the training may also be measured. The reaction of participants to a variety of issues related to the design and delivery of the training may also be assessed.

Level 2: Evaluation focuses on measuring the degree to which participants have absorbed and retained the desired skills, attitudes procedures, techniques, processes or knowledge that were the subject of the training.

Level 3: Evaluation focuses on the extent to which the material presented during the training is actually being implemented by training participants in the work setting.

Level 4: Evaluation focuses on the actual business impact as a result of the application of training content. The impact of training on specific metrics such as cost savings, time savings, increased output, quality improvements, increased customer satisfaction, and customer retention are measured at Level 4.

Level 5: Return on Investment. This is a comparison of the monetary benefits delivered by the training with the total actual cost of the training. There are several ways in which

this data is often presented, but most often it involves a ratio of the benefits of the training program to the cost of the program.

Intangible Benefits: Benefits that are not easily or credibly converted into financial value. Examples include improved teamwork, reduced absenteeism, and increased organizational commitment (J. Phillips & Stone, 2002).

Phillips and Stone assert that with the exception of Level 1, evaluation must be performed at each sequential level up to the highest level that will be measured. Although Level 1 data is helpful to have for the improvement of training initiatives, it is not always necessary. For example, if stakeholders are interested in evaluation at Level 4, data must be collected at Levels 3 and 2 as well (J. Phillips & Stone, 2002, p. 11).

The Philips ROI process has been used to assess the impact and return on investment of training programs in hundreds of businesses and government organizations (J. Phillips & Stone, 2002). The Phillips ROI Process is the methodology suggested by Phillips to evaluate training using the 5 Levels and Intangible Benefits. A summary-level description of the Phillips ROI Process is provided below.

Develop Objectives of Training (1): The first step in the Philips ROI Model. The purpose of this step is to generate an understanding of the scope of the training program and the business measures it is intended to impact. If the training initiative is new, data from the training needs assessment is used to generate goals for Levels 1 through 4. If the program

to be evaluated is already an existing program, the objectives and the content of the training are used to develop criteria and approaches for evaluation.

Develop Evaluation Plans and Baseline Data (2): The plan for collection training evaluation data is created. Evaluation metrics, data collection methods, data sources, and timing of data collection are planned for baseline and follow-up data. The ROI analysis plan is created, and the methods to isolate training impact and convert data to financial value are determined. Categories of cost that will be collected are also established. These first two steps comprise the planning for the rest of the process.

Collect Data During Training (3): Training is delivered. Evaluation is performed at Levels 1 and 2 during and immediately after training.

Collect Follow-Up Data After Training (4): Data is collected after the training in accordance with the timing and data collection methods specified earlier. This data will be used to evaluate the training program at the higher levels (Levels 3 through 5). The cost of the training is also calculated during this phase in accordance with the ROI Analysis Plan.

Isolate the Effects of the Training (5): The effects of the training are isolated from other factors using one or more methods that were specified in the ROI Analysis Plan.

Convert Data to Monetary Values (6): The impact of the training on the pre-selected business values will be converted into monetary value.

Identify the Costs of Training (7): Fully loaded costs of the training initiative are calculated.

Calculate the Return on Investment (ROI) (8): The return on investment for the training initiative is tabulated using the calculated monetary benefits of the initiative, and the fully loaded cost of the initiative.

Identify Intangible Benefits (9): The benefits of the training initiative that cannot be easily or creditably translated into monetary terms are identified. Intangible benefits can be very important to the stakeholders.

Generate an Impact Study (10): Two reports are produced at the end of the study. One report is relatively brief, and is intended for executive management. The other report is more detailed and is prepared for other stakeholders (J. Phillips & Stone, 2002).

It may take months or years from the beginning of the ROI Model to the end. Thus, this is not a suitable approach to evaluating training being delivered across an industry. The utilization of annualized values is becoming largely accepted when ROI of training programs are to be calculated. Using annualized training benefits makes the calculation of ROI more conservative since only the benefits generated within the first year of the training are considered in the calculation. Even short term training programs can continue to create benefits into the second and third years (J. Phillips & Stone, 2002, p. 27).

Baseline data must be collected for the training to be evaluated. There are many strategies that can be used to procure baseline data. One strategy that can be employed when the

researcher is prevented from gathering baseline data from organizational records or through other means is to structure a questionnaire so that before and after data is elicited from questionnaire participants (J. Phillips & Stone, 2002, p. 59). Phillips & Stone (2002) present nine factors that should be considered when developing an evaluation strategy for a training program:

1) Training participant location
2) Program duration
3) Importance of program in meeting the objectives of the organization
4) The amount invested in the training program
5) Participant's capability to be involved in training evaluation
6) Management interest and involvement in the evaluation process
7) Nature and content of the training initiative
8) Interest of senior management in the evaluation
9) Availability of business results metrics (J. Phillips & Stone, 2002, p. 62)

The choice of techniques used should be influenced by the disruptive potential of each technique, the level of disruption that would be acceptable, the cost required to collect the necessary data using each technique, the availability and quality of data, and the willingness of data sources to be cooperative in the training evaluation process. Several data collection techniques are suggested:

1) Follow-up surveys can be used to measure stakeholder satisfaction
2) Follow-up questionnaires are used to measure participant reaction and uncover specific issues that are inhibiting the application of training content.

3) On-the-job participant observation can be used to capture the actual application and use of training material.
4) Tests and assessments measure the extent of learning in the form of knowledge/skills enhanced or acquired.
5) Interviews are used to measure participant reaction and are used to evaluate the extent to which training content has been implemented by the participants.
6) Focus groups are used to evaluate the extent of application of the training content in the work environment.
7) Action plans are used to show progress with content implementation on the job and the impact obtained.
8) Performance contracts can be employed to detail specific outcomes expected following the training.
9) Monitoring of business performance shows improvement in performance records (J. Phillips & Stone, 2002, p. 65).

The impact of training must be isolated from the impact of other organizational initiatives. If stakeholders can easily be convinced that the estimated value realized as a result of the training, expressed in monetary terms is reasonable, then it is appropriate to proceed to Level 5, or ROI to examine the relationship between the cost of the training initiative, and the estimated benefits of the initiative.

Level 1 data is best used to locate problems and to make improvements in training design and delivery. Level 1 evaluation can also be used to make participants think about how they will use the training content in their work-environments. However Level 1 data is often of little utility for applications beyond these. Level 1 data is also often inaccurate because participants do not give candid responses regarding the training, and even when

candid responses are provided, they may be influenced by the recent attention from the trainer.

In some cases, additional questions can be included during the Level-1 evaluation that focus on the effects of participants' planned actions. In addition to how they plan to implement what they have learned, participants can also be asked to estimate the impact of the training they have received on the organization in financial terms, based on anticipated improvements in their efficiency, better teamwork, etc. Participants may even be asked to estimate the ROI of the training they have received based on the benefits that the organization experience due to their planned actions as a result of the training (J. Phillips & Stone, 2002, p. 79). Even though the responses are subjective, estimates, and future projections, the data can be valuable in many ways. The estimates should be adjusted so that they are more conservative and realistic. The following techniques can be used to make the estimates more credible:

- The benefits are based only on participants who report anticipated improvements. Participants who furnish incomplete responses, or whose responses do not show an anticipated improvement in performance are assumed to have no financial benefit to the organization.
- All costs should be fully loaded.
- Benefit numbers should be calculated with respondent confidence levels incorporated. If a survey respondent estimates a benefit of $10,000, with a 70%

certainty level, the response indicates that the respondent believes that the benefit to the organization will be between $7,000 and $13,000. The amount of $7,000 must be used as it is the most conservative.

- Despite the fact that if the training is successful, the organization should realize benefits for several years, benefits should only be counted for the first year after training is given.
- Experience has shown that even when tabulated using conservative estimates, projections given by trainees at the conclusion of a training program tend to not fully materialize. Unless an organization has developed it's own factor through experience, it should be anticipated that 50% of the financial benefits projected by trainees will not materialize.

If evaluation cannot proceed above Level 1, eliciting this type of feedback from participants provides more data than simple reactions to the training. This data is also presented in a format that is generally more useful to management than simple reactions. This type of feedback can also be used to contrast various deliveries of the same training material. Similarly, this approach could be employed to compare the delivery of the same subject matter using various delivery methods. Asking participants about expected financial return as a result of improved performance reinforces to participants that changed behavior is expected. Having training participants think about the financial benefit and ROI of the training also helps them plan how to apply their new knowledge

and skills. It is also beneficial to compare the ROI projected by participants at Level 1 when the actual benefits and ROI are calculated later (J. Phillips & Stone, 2002, pp. 81-82). Level-2 evaluation is used to determine the extent to which training participants actually acquired the desired knowledge and skills.

According to J. J. Phillips & Stone, a questionnaire

> "may request an opinion, such as a reaction to the training program, but it may also cover a variety of other issues and use different types of questions. A questionnaire has much more flexibility and can elicit data ranging from attitudes to specific improvement statistics. Questions may seek level-4 data, such as asking about changes in sales or improvement in quality since the program was conducted, or may be in a multiple-choice of fill-in-the-blanks format. Ranging from brief assessment forms to detailed feedback tools, questionnaires can be used to obtain subjective information about skill application as well as to document measureable business results for an ROI analysis. The questionnaire is the preferred method for capturing Levels-3 and-4 data in many organizations." (J. Phillips & Stone, 2002, p. 122)

The primary disadvantage of interviews as a data collection technique are that interviews tend to be expensive, for the researcher, the training participant, and the training staff. Analysis can also be complicated by the fact that some data obtained through interviews tends to be subjective. Organizational records and reports are the most reliable sources of data for evaluating training. This is the preferred source for data that will be used to evaluate the Level 4 impact on the organization since it typically accurately represents the impact on the organization.

Training participants are the data source most frequently used when training initiatives are evaluated. They are a very reliable source of data, since they are the individuals

whose actions have resulted in the benefits to the organization. They are also typically the most knowledgeable about other factors that have influenced the benefit added to the organization. Training participants are often able to provide rich data. Participants can be asked how they have applied the material they learned during the training in their work. Level 4 data can be obtained by asking training participants to explain how their actions have impacted the organization (J. Phillips & Stone, 2002, p. 145).

The effect of the training should be isolated from other factors that have influenced organizational performance. Many factors may influence organizational performance. Focusing on variables that may have impacted performance adds credibility to the results of the evaluation. The reliability of results that were generated without considering the impact of other factors external to the training is often questionable. Phillips and Stone propose numerous strategies that can be used to isolate the effects of training from other organizational factors, including using control groups, the use of trend line analysis, forecasting, using training participant estimates, using the estimates of supervisors or management, soliciting customer input, incorporating expert input, using subordinate input, or by evaluating the impact of other factors (J. Phillips & Stone, 2002, p. 158).

Using training participant input as a technique to isolate the impact of training is a technique that often has substantial credibility with management, because the actions of training participants are directly responsible for the benefit the organization experiences. Training participants should know or be able to estimate how much of the impact is

attributable to the training program. Despite the fact that the information is based on the estimates of training participants, this is an accurate and credible method of isolating the effects of the training initiative.

Regardless of which techniques are used to isolate the effects of training, when the results of the training evaluation are presented, the audience should be notified that the results represent the best estimate of the impact of the training subject to the time, resources, and other constraints of the research, and that the results are subject to contain error.

Phillips & Stone (2002, p. 173) state that audience members will judge the data based on the following criteria: The reputation of the data sources, the reputation of those administering the research, the motives or underlying interests of the researchers, the quality of the methodology used, the assumptions employed in the research, how reasonable and relevant the outcome data is, whether the outcome data is objective and hard or subjective and soft in nature, and the scope of the research.

Training benefits can be categorized into hard benefits and soft benefits. The following two tables are from Phillips & Stone, 2002. Hard benefits are easily assigned a monetary value and are objectively in nature, straightforward to measure and quantify, highly credible with management, and are typical organizational indicators of performance (J. Phillips & Stone, 2002, pp. 177-178). Soft benefits tend to be subjective, challenging to directly measure and quantify, hard to assign quantitative value, usually oriented toward

behavior, and not as credible as hard data as performance metrics (J. Phillips & Stone, 2002, p. 178).

Table 3: Examples of Hard Data
*from Phillips & Stone, 2002, p. 179

General Area of Improvement	General Area of Improvement
Output	**Time**
Units Produced	Equipment downtime
Tons manufactured	Overtime
Items assembled	On-time shipments
Money collected	Time to project completion
Items sold	Processing time
Forms processed	Supervisory time
Loans approved	Break in time for new employees
Inventory turnover	Learning time
Patients visited	Meeting schedules
Applications processed	Repair time
Students graduated	Efficiency
Tasks completed	Work stoppages
Output per hour	Order response
Productivity	Late reporting
Work backlog	Lost-time days
Incentive bonus	
Shipments	**Quality**
New accounts generated	Scrap
	Waste
Costs	Rejects
Budget variances	Error rates
Unit costs	Rework
Cost by account	Shortages
Variable costs	Product defects
Fixed costs	Deviation from standard
Overhead cost	Product failures
Operating costs	Inventory adjustments
Number of cost reductions	Time-card corrections
Project cost savings	Percent of tasks completed properly
Accident costs	Number of accidents
Program costs	
Sales expense	

Table 4: Examples of Soft Data
*from Phillips & Stone, 2002, p. 180

General Area of Improvement	General Area of Improvement
Work Habits	**Employee Development/Advancement**
Absenteeism	Number of promotions
Tardiness	Number of pay increases
Visits to the dispensary	Number of learning programs attended
First aid treatments	Requests for transfer
Violations of safety rules	Performance appraisal ratings
Number of communication breakdowns	Increases in job effectiveness
Excessive breaks	
Follow-up	**Initiative/Innovation**
	Implementation of new ideas
Work Climate/Satisfaction	Successful completion of projects
Number of grievances	Number of suggestions implemented
Number of discrimination charges	Settings goals and objectives
Employee complaints	New products and services developed
Job satisfaction	New patents and copyrights
Employee turnover	
Litigation	
Organizational commitment	
Employee loyalty	
Increased confidence	
Customer Service	
Customer complaints	
Customer satisfaction	
Customer dissatisfaction	
Customer impressions	
Customer loyalty	
Customer retention	
Customer value	
Lost customers	

Again, training participants' estimates is a recognized approach for converting hard and soft benefits into monetary values (J. Phillips & Stone, 2002, p. 181).

The advantage of using training participants' estimates of the value of soft data improvements is that often, training participants are able to provide the most reliable estimates since they are closest to the improvements that are responsible for delivering value to the organization (J. Phillips & Stone, 2002, pp. 189-190).

The identification of training program costs is one of the most important aspects of evaluating the ROI of training initiatives. Calculated program costs must be accurate, reliable, and realistic. Training budgets are easily determined, however it is significantly more difficult to calculate actual training costs, including indirect costs related to the training (J. Phillips & Stone, 2002, p. 199). Under-estimated actual costs will artificially inflate ROI calculations (J. Phillips & Stone, 2002, p. 200). To ensure that ROI calculations are conservative and reliable, it is suggested in the literature that only benefits realized in the first year after training be considered in calculations (J. Phillips & Stone, 2002, p. 219).

Table 5: Training Cost Categories
*from Phillips & Stone, 2002, p. 204

Cost Item
Needs assessment
Design and development
Acquisition
Delivery
Trainer salaries and benefits
Training coordination salaries and benefits
Program materials and fees
Travel/lodging/meals
Facilities
Participant's salaries and benefits
Contact time
Travel time
Preparation time
Evaluation
Overhead/training and development

In addition to tangible benefits, a majority of training initiatives generate intangible benefits as well. Intangible benefits are positive outcomes that either cannot be converted into monetary value, or that would not be time or cost efficient to translate into monetary units. The scope of intangible benefits is virtually unlimited. Common intangible benefits are identified in the table below.

Table 6: Examples of Common Intangible Benefits
*from J. J. Phillips & Stone, 2002, p. 224

Intangible Benefit
Increased job satisfaction
Increased organizational commitment
Improved work climate
Fewer employee complaints
Fewer employee grievances
Reduction of employee stress
Increased employee tenure
Reduced employee lateness
Reduced absenteeism
Reduced employee turnover
Increased innovation
Increased customer satisfaction
Decreased customer dissatisfaction
Enhanced community image
Enhanced investor image
Fewer customer complaints
Faster customer response time
Increased customer loyalty
Improved teamwork
Increased cooperation
Reduction in conflict
Improved decisiveness
Improved communication

Phillips & Stone (2002) state that intangible benefits typically consist of either behavioral/implementation intangibles (at level 3) or business impact intangibles (at Level 4). Behavior intangibles may include enhanced teamwork, increased organizational commitment, improved cooperation, better communication. Behavior intangibles that can

be creditably converted to level 4 metrics become level 4 intangibles. Typical level 4 intangibles include improved customer satisfaction, increased employee satisfaction, reduced employee complaints, decreased absenteeism, and reduced employee turnover. If monetary value can be creditably attached to any level 4 metric, the metric ceases to be an intangible benefit, and becomes a tangible benefit (J. Phillips & Stone, 2002, pp. 224-225).

2.2.4 Effectiveness of Various Training Techniques

Much research has been done regarding the use of various training techniques in business settings (Utgaard & Dawis, 1970). The results are somewhat mixed, but tend to show that training delivery method does not influence the effectiveness of training. Compiled by Russell (2001), the *No Significant Difference Phenomenon* is a collection of 355 research reports, summaries and papers that document no significant difference in learning outcomes between various modes of education delivery. Bohlen (1993) found that college students that learned word processing software using computer based asynchronous instruction significantly outperformed their peers that took the same course in a traditional classroom based environment. A study conducted by Coppola and Myre (Coppola & Myre, 2002) found little significant difference in knowledge acquisition between identical courses taught via web and instructor-led classroom training in a corporate environment. Trainees were taught how to use a stand-alone software application using their own computers and the familiar corporate IT infrastructure.

2.2.5 Efficiency of Various Training Techniques

Corporations praise web-based training as effective, cost-effective, and convenient way to deliver training (Strother, 2002). Web and computer based training can offer organizations training at reduced costs compared to tradition classroom training. Classroom training can require organizations to spend large amounts of money on travel, accommodations, and facilities. Instructors can arrive at training facilities exhausted and unable to provide the highest quality of instruction. However, modern organizations can transmit the information to the trainees, instead of the other way around (Greengard, 1999).

Dossett and Hulvershorn (1983) conducted a study of U.S. Air Force Personnel during a one-week segment of a 36 week training course on electronic principles. The study was designed to compare training outcomes between conventional classroom training, individual computer assisted instruction (CAI) where individual learners were trained via a training terminal, and paired CAI training where groups of two trainees trained together on a workstation. Instructors were available at all times to supervise and to help learners if they experienced difficulty with training materials, equipment, or laboratory exercises. No significant differences were found in scholastic achievement scores between the three groups. However, substantial differences in training completion times were observed. The conventional classroom training was delivered per the course syllabus in 30 hours. Learners in the individually trained CAI group completed the training in a mean time of 18.90 hours, or 37% less time than the group trained in the conventionally trained

classroom group. Learners in the paired CAI training group finished the training in a mean time of 15.24 hours, or 49.2% less time than the group trained in the classroom.

Despite the availability of instructors, the mean student-instructor contact time among CAI trained leaners was extremely low (less than 2% of total training time). Dossett and Hulvershorn note that low student-instructor contact times imply that more training can be conducted with a smaller staff, instructors may have the capacity to provide additional individual help to learners when required, instructors may have the capacity to provide individualized instruction, and that CAI may help address resource constraints such as limited classroom space or a shortage of qualified instructors. Dossett and Hulvershorn further observe that shorter training times mean fewer dollars spent per student. This is especially true when learners are paid while in training. Students that finish training in less time are also able to return to work more quickly (Dossett & Hulvershorn, 1983).

The average annual direct expenditure per employee on training for the 316 organizations surveyed for the 2008 ASTD State of the Industry Report was $1,102.59. This represents 2.15% of payroll (without benefits or taxes), 7.54% of profit, and .56% of gross revenue (Paradise, 2008). The average annual direct expenditure per employee on training for the 301 organizations surveyed for the 2009 ASTD State of the Industry Report was $1,067.74. This represents 2.24% of payroll (without benefits or taxes), 8.75% of profit, and .59% of gross revenue (Paradise & Patel, 2009). The average annual direct expenditure per employee on training for the 304 organizations surveyed for the 2010

ASTD State of the Industry Report was $1,081.18. This represents 2.14% of payroll (without benefits or taxes), 10.88% of profit, and .71% of gross revenue (American Society for Training and Development, 2010).

The average employee consumed 37.41 hours of training in 2007 (Paradise, 2008). The average cost per hour consumed was $55.62. The average cost per hour available was $1,660.23. The ratio of reused content was 44.78. This means that on average each hour of learning content was used 44.78 times. The average employee consumed 36.25 hours of training in 2008 (Paradise & Patel, 2009). The average cost per hour consumed was $51.68. The average cost per hour available was $1,528.16. The ratio of reused content was 59.45. The average employee consumed 31.87 hours of training in 2009 (American Society for Training and Development, 2010). The average cost per hour consumed was $62.78. The average cost per hour available was $1,398.46. The ratio of reused content was 56.32. Tuition reimbursement costs accounted for 12.6% of organizational learning budgets in 2007, 11.93% in 2008, and 10.67% in 2009. Costs for external learning providers made up 25.18% of costs in 2007, 21.99% of costs in 2008, and 26.88% of costs in 2009. (American Society for Training and Development, 2010; Paradise, 2008; Paradise & Patel, 2009).

2.3 The Value of Formal Project, Program, and Portfolio Management

To date, there has been a significant amount of research published on the value that project management offers to organizations (J. Thomas & Mullaly, 2008). The research that has been published to date on the value of project management can be leveraged to gain insight into benefits that result from implementing Project Management Information Systems, and thus the implementation of training initiatives during the PMIS implementation.

A five year study by Ibbs and Reginato found that as Project Management Maturity increases, the Return on Investment (ROI) on Project Management increases. In addition to increasing the ROI for Project Management, organizations with mature project management practices benefit from enhanced project cost and schedule performance, and reduced standard deviations in SPI and CPI across projects. Reduced variation in SPI and CPI means that as project management maturity increases in organizations, those organizations enjoy less variation in project cost and schedule variances (Ibbs & Reginato, 2002).

Thomas and Mullaly observed the following categories of tangible value within organizations that implement project management: Cost savings, increased revenue, customer retention, increased customer share, greater market share, and reduced write-offs and rework (J. Thomas & Mullaly, 2008). However, the Mullaly Thomas study found that many organizations were not realizing tangible value from their project management implementations. Thirty two out of 60 organizations evaluated were not able

to demonstrate any tangible value. However, in organizations where tangible value was delivered, tangible value was found within organizations with all levels of project management maturity. Little correlation was found between the maturity of project management within the organization, and the degree of tangible benefit being delivered. Even organizations at low levels of maturity displayed high levels of tangible value. Several of the organizations studied that exhibited high levels of tangible value had relatively simple and straightforward project management implementations, and some of those organizations had implemented only superficial and minimal project management practices. Thomas and Mullaly found that tangible value was most often evidenced in organizations that perform work for customers. Of the organizations that were found to realize high levels of tangible value, the majority were consulting or construction and engineering companies that engage in project activities for their customers on a contract basis. The other organizations that were found to exhibit high levels of tangible value were departments within organizations that oversee large-scale and infrastructure projects. Even in organizations where tangible value is demonstrated, very few organizations could actually quantify the value being realized. None of the examined organizations had captured the value delivered by the project management implementation as a separate amount. All of the organizations demonstrating tangible value were able to articulate the value, some were able to provide anecdotal scenarios to illustrate the value, however none had actually performed formal measurements of the value being delivered. Furthermore, the researchers found no interest within the

organizations of actually quantifying the value being delivered by project management. (J. Thomas & Mullaly, 2008, p. 232).

Thomas and Mullaly identified the following as motivators for the initial development of organizational project management implementations: Increasing project complexity, growing numbers of projects, projects experiencing time pressure, market pressures, competitive pressures, maintaining an appearance of being current, best practices, and globalization. In addition, Thomas and Mullaly also identified the following as overall objectives that organizations endeavor to realize as a result of implementing project management: Improved project performance, improved business case realization, accelerated project delivery, project cost reduction, increased organizational credibility, the achievement of a competitive advantage, and improved alignment with partner expectations and commitments (2008).

Over half of the organizations studied by Thomas and Mullaly in the course of a large study of the value of project management were not able to demonstrate tangible value. Twenty percent of the organizations studied were found to have received some tangible value, but the tangible value was at best marginal. Approximately 22% of the organizations were found to have experienced significant level of tangible value. Five percent of the organizations examined were deemed to have experienced an extremely high level of tangible value. Most organizations where tangible value was shown to exist were not able to definitively quantify the value. None of the organizations studied

attempted to demonstrate an ROI for their project management implementation. Few of the organizations examined collected cost information for their project management implementation or attempted to quantify actual benefits realized. The organizations that came closest to being able to calculate ROI were from the consulting and construction industries and used project management primarily in the performance of projects for external customers. There was significant number of study participants who reported a strong belief that the organization's project management implementation provided a good return for the money invested than were able to provide data that could be used to provide a partial calculation of the value retuned.

Intangible benefits of project management proposed by Thomas and Mullaly (2008) include the following: Ability to attain target project scope, ability to achieve driving project priorities, satisfaction of project sponsor, user satisfaction, satisfaction of project team, improved project team efficiency, improved multi-project coordination, enhanced project control, greater transparency in project status and reporting, improved project performance, better organizational culture, more entrepreneurship, increased innovation, better knowledge management, improved communication, increased customer retention, improved customer share, enhanced competitiveness, reduced write-offs and rework, achievement of strategic objectives, introduction of new products and services, improved social good, enhanced quality of life, more effective human resource management, increased staff retention, improved organizational reputation, better overall management,

improved corporate culture, improved regulatory compliance (J. Thomas & Mullaly, 2008, p. 208 and 230). Many of these benefits should be observed in organizations implementing PMIS.

Thomas and Mullaly (2008) found that almost all of the organizations examined were experiencing intangible value as the result of their project management implementation. In addition, almost two-thirds of the organizations studied were realizing significant amounts of intangible value. Eleven out of the 60 organizations studied were experiencing intangible benefits at the highest level the study captured. The level of intangible value being realized by organizations appeared to be positively related with the maturity of project management within the organization. With only one exception, all of the organizations experiencing significant levels of intangible value (level two or higher) were at an advanced maturity level (level two or higher). (J. Thomas & Mullaly, 2008).

The study also examined trends in the value of project management within implementing organizations. This aspect of the research was intended to examine the degree to which the project management implementation was being supported and maintained, and the degree to which the implementation would continue to generate value in the future. To capture the projected creation of value within each organization, a five point scale was used to code the anticipated value that each organization's implementation of project management was expected to deliver. The value coding scale utilized is summarized in the following table.

Table 7: Thomas-Mullaly Value Trend Codes

Numerical Code	Thomas-Mullaly Value Trend Code Definition
2	Evidence of value delivered to-date within the organization. Strong trend toward organization continuing to be able to realize value from its project management implementation. Strong and continued emphasis on project management within the implementation. Value is anticipated to increase at a significant rate or provided at a significant level.
1	The project management implementation has demonstrated value, but is expected to continue to deliver increased value at a more gradual level.
0	The project management implementation has demonstrated value, but has reached a plateau. It is questionable whether the project management implementation will continue to deliver value. The continuation of the project management implementation itself may be in question. For some organizations, there exists a risk that the value will decline in the future.
-1	The value delivered by the project management implementation is declining, but at a moderate rate. Strong value may have been delivered to date, however that level of value is not being maintained and is anticipated to continue to decline gradually over time.
-2	The value being delivered by the project management implementation was observed to have deteriorated significantly and continued to be rapidly declining.

A majority of the organizations examined had project management implementations with positive value trends, 34 of 60 organizations having a value trend of 1 or greater. Twenty two organizations were identified as having a value trend of 0.

2.4 Additional Factors That Impact Training Effectiveness

Many factors have been shown to impact the effectiveness of training. Pretraining conditions, needs analysis, participant motivation, in-training conditions, individual and situational characteristics, and participation in developmental activities have all been shown to effect knowledge transfer during training (Eduardo Salas & Cannon-Bowers, 2001). The importance of a needs analysis prior to training implementation has been documented (K. Gupta & American Society for Training and Development., 1999). One study of perceived effectiveness among training participants showed a strong positive relationship between perceived effectiveness of training, a positive organizational environment and appropriateness/relevance of training material/knowledge/skills to participants needs (Schumaker, 2004). Atkins & Gilbert found that visible management support is essential for team member induction training programs (2003). Facteau et. al. (1995) found a significant relationship between pretraining motivation and perceived training transfer among training participants. While finding no direct relationship between organizational commitment and perceived training transfer, Facteau et. al. (1995) found that organizational commitment effects perceived training transfer through its effect on pretraining motivation. The factors that impact the effectiveness of training have been researched extensively. In addition, practitioners who are considering the implementation of PMIS training as a means to increase organizational PMIS maturity may consider these other factors independently.

2.5 Measuring the Cost of Training

According to Phillips and Phillips (2007), the cost of learning programs is typically considered from one of two perspectives. For the purposes of organizational budgeting, general information requests, and program approvals, reported and estimated costs often include only direct costs. Administrators and executive management are often only interested in the direct costs. However, for deeper financial analysis and when ROI is to be calculated, learning costs must be fully burdened to include all direct and indirect costs. In these situations, calculated cost components must include:

- Learning needs assessment, design, and development. These costs may be prorated over the anticipated life of the initiative.
- Any instructional materials provided to participants
- Instructor costs. This includes all preparation time.
- Facilities to be used for training.
- All travel, meal, and lodging costs for participants
- Salaries and employee benefits for participants
- Overhead and administrative costs
- Learning evaluation. This includes planning, data collection, analysis, and reporting. (P. Phillips & Phillips, 2007, p. 26)

When evaluating training initiatives, the calculated cost of the program must be accurate, reliable and realistic. Generally, determining the budget for training is straightforward, however calculating the actual cost of the training program and the direct costs associated with the training is more challenging (J. Phillips & Stone, 2002, p. 199).

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2.6 Detrimental Factors to PMIS Value

Adoption-risk is frequently cited by vendors and end user organizations as the biggest threat to a PMIS investment. Implementations that lack management support, lack accountability, were designed without sufficient stakeholder input, or have objectives that are not communicated to end users are likely to see a much slower rate of adoption, and thus a slower time-to-value, if indeed any value is generated at all (Symons, 2009). The implementation of a project management information system will deliver value in proportion to the capabilities afforded to the implementing organization; systems with limited capabilities can be expected to deliver limited value whereas feature-rich systems can deliver more value. However, as the scope of the implementation becomes broader and implementations become overly complicated, costly system integrations and customizations can make the cost and risk of the implementation rise dramatically (Symons, 2009).

Raymond & Bergeron (2008) found that the quality of information output from a PMIS is strongly associated with the quality of the system itself, where the quality of the PMIS

was measured using the following eight factors: accessibility, response time, flexibility, ease of use, querying ease, learning ease, systems integration and multi-project capability. Quality of information was defined in terms of the following six factors: availability, relevance, reliability, precision, comprehensiveness, and security. Thus a system that lacks sufficient sophistication is likely to produce data of poor quality.

System quality was found not to directly influence use of the PMIS, however an indirect relationship.

One of the fundamental theories underlying the Thomas research is that the value an organization experiences as the result of implementing project management is a function of both the context the organization operates in and the project management implementation the organization has undertaken. Neither dimension alone would be sufficient to determine the value that an organization has realized from project management. Another concept present in the Thomas research is the concept of fit. The idea of fit is an articulation of whether the implementation of project management is appropriate for the organization (J. Thomas & Mullaly, 2008, p. 190). The relationship of context and fit to the implementation of a PMIS will also effect the value generated by the PMIS.

CHAPTER 3: RESEARCH QUESTIONS AND METHODOLOGIES

3.1 How is PMIS Training Being Delivered?

A majority of the information systems research and literature to date focus on functional and non-project driven organizations. Project-driven organizations represent a distinct group that have unique needs (Ali, et al., 2008). Although industry reports provide general insight into how organizations are delivering training, there is no data available on how organizations are providing PMIS training. Organizations and decision-makers who are considering the implementation of PMIS training have no way of knowing how organizations are delivering training.

The 2010 ASTD Industry Report defines training in terms of the following delivery methods: live in-person instructor led, instructor led online training, instructor led remote, self-paced online, self-paced non-networked (i.e. CD-ROM), self-paced print, non-computer technology (A/V, mobile devices), blended learning (a combination of synchronous and asynchronous classroom and e-learning), coaching, mentoring, learning management systems, simulation, and tuition reimbursed educational coursework (American Society for Training and Development, 2010).

To determine how contemporary project-based organizations are delivering PMIS training, a survey was developed to collect data on the use of following training delivery methods: live in-person instructor led classroom training, web-based training, “lunch and

learn" style training, conference attendance, participation in professional organizations that conduct events on project management toolset usage.

3.2 How Can the Value of PMIS Training Be Measured?

Empirical studies that probe the benefits of project management software and explore patterns of its usage are extremely limited (Ali, et al., 2008). This translates into a lack of proven metrics with which to measure PMIS training initiatives across organizations. To measure the impact of the PMIS training that organizations are currently delivering, it was necessary to define a methodology to measure the value of the training. The five-level Kirkpatrick/Phillips model of learning evaluation is the most common technique used to evaluate training programs (American Society for Training and Development, 2009). For the purposes of this research, a rigorous implementation of the Philips/Kirkpatrick method of training evaluation would be unacceptable for an industry analysis because of the long duration and intensive effort necessary to integrate training evaluation into all steps and phases of training implementation initiatives (pre-training planning, training delivery, and post-training analysis and data collection) (J. Phillips & Stone, 2002).

To measure the value and effectiveness of PMIS training initiatives, training outcomes have been measured in terms of increased individual software proficiency, and increases in areas where project and program management software is shown to increase

organizational value. Key learning outcomes will be distilled into metrics that can be coded into a survey tool. The learning outcomes must be application-neutral so that they will apply to all organizations that implement PMIS software. Key value metrics must be applicable to organizations that manage projects in a wide range of industries, and must be germane to organizations that manage varying numbers of large and small projects.

3.3 How Effective is Each Training Technique at Increasing PMIS Key Value Metrics?

The project management practice has long recognized the importance of training and educating its professionals (Pant & Baroudi, 2008), however as an increasing number of organizations implement project and program management systems, management personnel have no way of knowing what training delivery methods are providing the best results for other organizations. There is currently no empirical data available that measures the effectiveness of various training techniques in increasing individual proficiency and organizational value provided by enterprise project management software. Research suggests (Coppola & Myre, 2002; Russell, 2001) that electronically delivered training may be as effective at increasing learning outcomes as traditional live-instructor led classroom training, however, there is no data to corroborate this within a general PMIS training context. To report on the effectiveness of the training that is being delivered, survey participants were asked to respond to a series of questions that rate how

the training that they have been given in the past year has impacted their proficiency level with the PMIS tools they use and the value to their organization.

The effectiveness of each training technique was measured using the key value metrics derived in the previous section. To determine the impact of PMIS training, survey respondents were asked to rate the impact of the training they received in the past year via each one of the training delivery methods identified in section 3.1 on their individual proficiency with their organization's PMIS toolset. Survey respondents were also prompted to provide their skill level with the toolset before the training and after the training using a specially constructed scale. The data collected from this portion of the survey offers insight into which training delivery methods are creating greater increases in individual proficiency levels with the toolsets among practitioners.

To capture the impact of training on the key value metrics that relate to the organizational value provided by a PMIS, respondents were asked to rate how training they have received in the past year via each of the delivery methods identified in section 3.1 has enhanced their individual skill levels and the competencies of the organizational unit. Respondents were instructed to leave areas blank for training delivery methods that were not received, areas that the training did not address, or functions for which the organization does not use the PMIS for.

3.4 How Efficient is Each Training Technique at Increasing PMIS Key Value Metrics?

Organizations and management personnel that are considering investment in a PMIS deployment currently have no way of knowing what the most efficient training techniques are in terms of training time and cost of learning. No empirical data exists that measures the efficiency of various training techniques in increasing the organizational value and individual proficiency provided by project management information systems. To investigate the efficiency of each training delivery method, the number of courses training participants attended in the past year, the number of training hours completed, and the number of training hours made available to learners for each of the delivery methods described in section 3.1 will be asked of survey respondents.

Survey respondents were asked to provide estimated costs paid for the training they received if known. PMIS training efficiency data were calculated using the impact of each training delivery method on individual user proficiency and organizational value, together with hours consumed of training. It was anticipated that many respondents would not know exact costs paid for training. This would be especially true for training that has been developed and delivered internally, since survey respondents would likely not know the amount of effort required to develop the material, the rates of the developers or delivery costs. Internally developed and delivered training content also may be old, which would mean that a bulk of the costs for the training have already been paid for.

3.5 What is the Relationship Between PMIS Training and Project/Program Size, Number of Resources/Tasks, Complexity, Dollar Value, and New Users vs. Experienced Users?

Organizations that want to use training to increase the value provided by their PMIS will want to know how the unique characteristics of their organization and people effect training requirements. At present time, there is no empirical data available on organizational characteristics, individual factors, PMIS training needs, and training effectiveness. To explore how different characteristics are effecting training outcomes in organizations that currently use Project Management Information Systems, the following data is examined: the functional role of the survey respondent, the number of years of experience in project management and using project management software of survey respondents, the maturity of the PMIS implementation, the length of time the current PMIS has been in place, prior PM software use within the organization.

3.6 What is The Appropriate Amount to Pay for PMIS Training?

Organizations currently have no way of objectively evaluating whether the amount they are paying for PMIS training is appropriate. E-learning offers significant savings because of the ability for content to be re-used. (American Society for Training and Development, 2010; Paradise, 2008; Paradise & Patel, 2009). Forrester Research employs a methodology termed "Total Economic Impact™" (TEI) for analyzing and evaluating the costs, benefits, and risks of a various proposed organizational Project Management Information System investment. The idea behind the TEI is an economic model that is

generated using realistic assumptions for human resource requirements, cash flow, efficiency, organizational adoption timelines, hardware and software investment required, etc. In addition, relevant risks are quantified in light of the organizations goals. The result is a decision-making tool that gives planning personnel insight into the future economic prospects of each potential investment decision (Symons, 2009). A similar approach has been employed to produce a model to examine different PMIS training scenarios and the appropriate amount to pay for PMIS training, or alternatively, how much is too much to pay for training, based on data collected from practitioners in industry.

CHAPTER 4: A FRAMEWORK FOR THE MEASUREMENT OF THE IMPACT OF PMIS TRAINING

4.1 Elements of Framework Composition

The proposed Project Management Information System (PMIS) Training Impact Assessment Framework is a structured and organized collection of beneficial PMIS training outcomes, focusing on recipients of benefits, and documented creator of benefits. The framework contains an assemblage of beneficial positive outcomes that are hypothesized to be created by PMIS training based on current literature and expert input.

To maximize the utility, universal applicability, and flexibility of research outcomes, the proposed framework does not prescribe evaluation methodologies or processes, specific measurement techniques, scales, or units of measure for use in evaluation.

Included with the proposed framework are the 172 unique benefits documented in the literature, the Individual/Workgroup/Organization recipient classification, and potential benefit source discipline. Excluded are measurement plan specifics, evaluation methodologies, or scales to measure training outcomes. Expert scores are provided to facilitate improved insight into the methodologies used in this research.

Table 8: Functional Representation of Framework as Evaluation Instrument.

Measure Against All Relevant Criteria within the 172 Elements of the PMIS Training Impact Assessment Framework

Area No.	1				2	3	4	5	6	7	8	9	10	11	12
12 Areas of Positive Impact	Accountability				Attitude	Communication & Collaboration	Cost/Time	Effectiveness and Efficiency	Knowledge Management	Market Presence	Strategic and Enterprise	Performance	Resource Management	Risk	Stakeholder Management
172 Unique Benefits	1	2	3	4+ …	…	…	…	…	…	…	…	…	…	…	… 171 172
Scores for Benefits Desired at the Organiz. Level	*Ignore. Not Relevant.*	Initial; Target; Final	*Ignore. Not Relevant.*	Initial; Target; Final	…	…	…	…	…	…	…	…	…	…	… 171 172
Scores for Benefits Desired at the Workgroup Level	Initial; Target; Final	Initial; Target; Final	Initial; Target; Final	Initial; Target; Final	…	…	…	…	…	…	…	…	…	…	… 171 172
Scores for Benefits Desired at the Individual Level	Initial; Target; Final	*Ignore. Not Relevant.*	Initial; Target; Final	Initial; Target; Final	…	…	…	…	…	…	…	…	…	…	… 171 172

This research builds off of the stakeholder-centric approach employed by Ibbs & Reginato (2002) and Zhai, Xin, & Cheng (2009). Aguinis & Kraiger (2009) propose that training benefits realized at the individual level may cascade to the team level, and benefits realized at the team level may cascade to the organizational level. Kaiser & Ahlemann (2010) suggest that the benefits made available by project management information systems can be grouped into three general categories: individual benefits, workgroup benefits, and organizational benefits.

Building off of Aguinis & Kraiger (2009), this research analyzes the impact of project management at the individual, project team, and organizational levels. Because of the current lack of research in project management software training, it is theorized that when organizations decide to deliver formal PMIS training, they can expect to realize benefits that are offered by (1) project, program, and portfolio management software and supporting systems, (2) general business training, and (3) the implementation of formal project, program, and portfolio management.

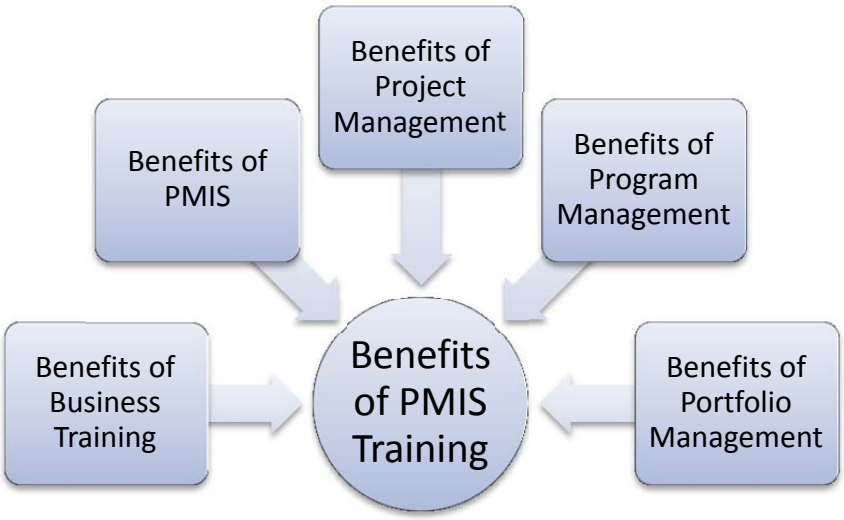


Figure 1: Central Amalgamation of Benefits as Basis of Creating Framework

The key value metrics have been "compartmentalized" by capability so that organizations that do not use PMIS software for all currently available functions can simply ignore the ones they do not use. Leveraging the concept of KPI employed by OPM3 (Project Management Institute., 2008b), the elements of the framework are intended to serve as criterion against which an organization can determine whether an outcome exists, and/or the degree to which it exists.

4.2 Benefits Capture and Refining

Initial Capture of Raw Benefits from Literature Analysis

To create the PMIS training evaluation and planning framework, an expansive multi-disciplinary review of existing scholarly literature was undertaken. A review of existing scholarly academic and practitioner literature was conducted within each of the 3 disciplines: PMIS, Training, and PM. Literature content was specifically analyzed for instances where the use of PMIS, training, or PM had resulted in positive outcomes through a well-defined causal relationship.

Where a well-defined cause-effect relationship was observed to be present, the full direct quotation was recorded from the source, and the specific benefit created was documented. When citations were found to contain more than one benefit, each purported benefit was documented separately. The unique context of each quotation were then used to classify each instance of a documented benefit were then categorized according to whether they would most likely be realized at the individual, workgroup, or organizational levels, in accordance with Kaiser & Ahlemann (2010). In total, 1,450 instances of positive benefits were documented in 848 direct citations. The PMIS literature produced 243 direct quotes, the training literature produced 130 direct quotes, and the PM literature produced 475 direct citations.

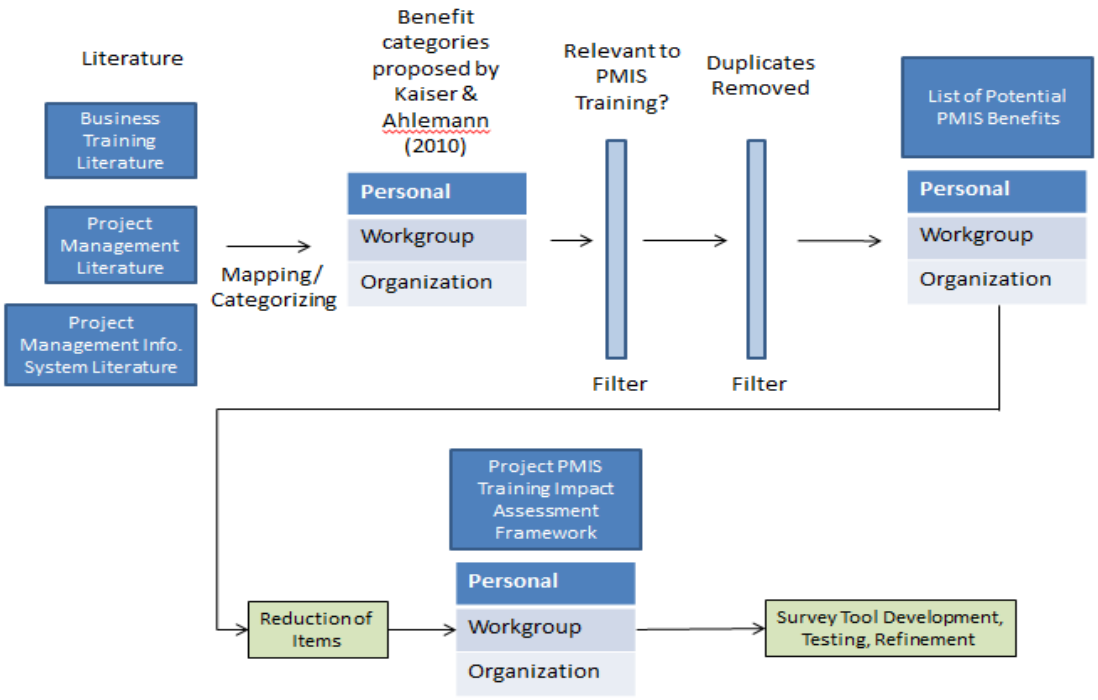


Figure 2: PMIS Training Impact Assessment Framework Development Lifecycle

Refining of Raw Benefits

The categorized benefits were subjected to an initial induction refinement, based on whether they would be likely to occur as a result of PMIS training. Poorly fitting/aligned benefits that had been captured from the literature were eliminated. Consistent with the research plan, the raw data collected from the literature contained numerous instances of a singular benefit documented multiple times A) within the same reference document, B) in other references from the same discipline, C) and across disciplines.

Duplicate benefits that resulted from the same benefit being created by more than one input were then removed so that each benefit in the framework is unique. A total of 290 unique benefits were documented. These 290 "second level" benefits (more detailed, lower-level benefits like improved profitability) were recorded from the literature. The 290 second level benefits (for example: improved customer satisfaction) have been classified into 12 High-Level Areas of Improvements (for example: Stakeholder Management) that provide a context for the general area of potential positive improvement.

Iterative Benefit Refinement

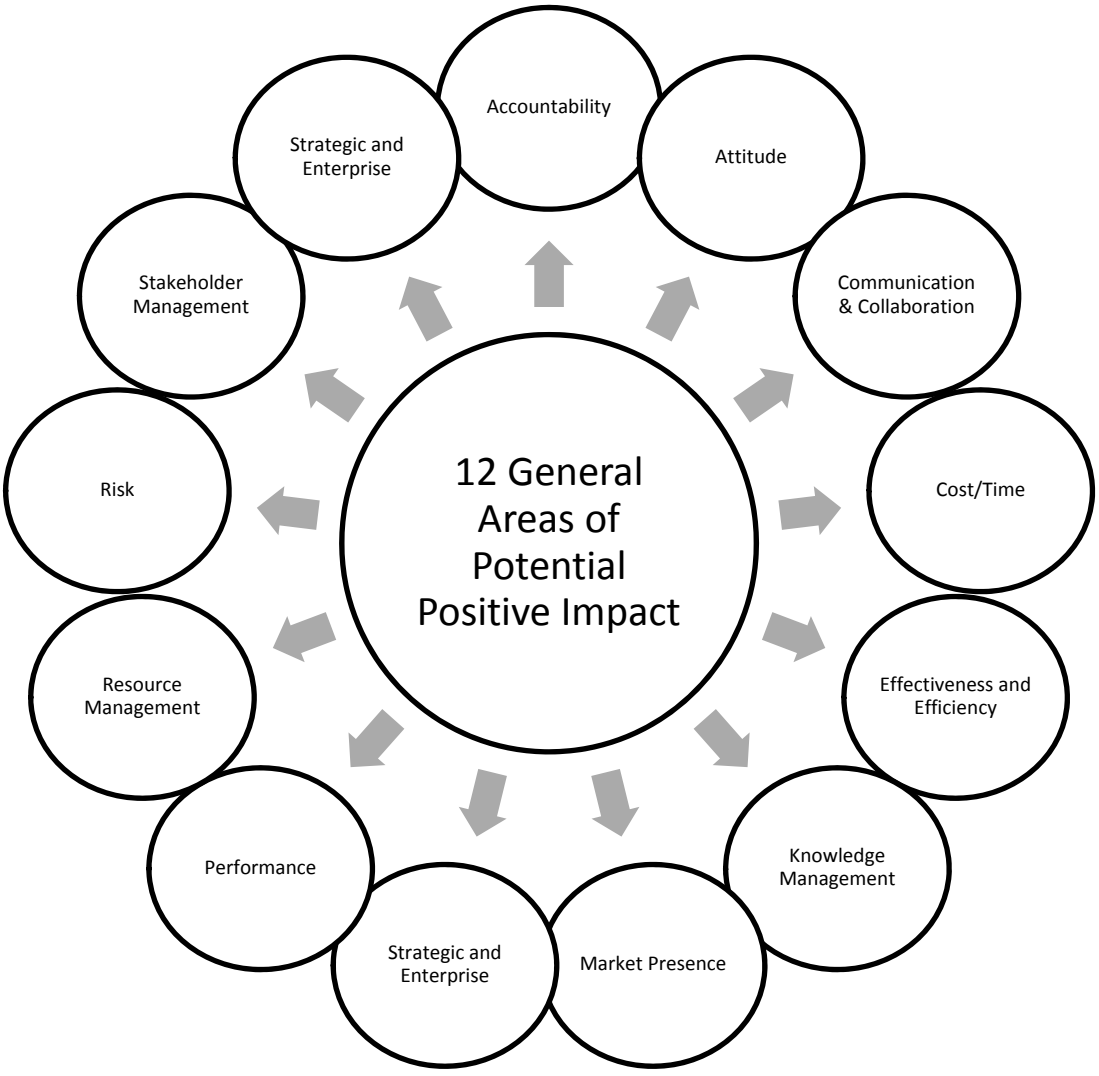
The 290 benefits were then subjected to a series of progressive editing and review cycles. Each cycle was holistic in nature and was intended to 1) combine homogenize similar benefits, 2) condense benefits observed in more than one branch of the literature, 3) remove benefits unlikely to be caused by PMIS training. 4) reduce the number of final elements to the lowest number possible without eliminating valuable data from the framework. The sequential editing and refining reduced the number of benefits from an original number of 290 benefits documented in the literature, to a final number of 172 unique benefits.

4.3 Proposed Framework for the Measurement of the Impact of PMIS Training

The proposed Project Management Information System (PMIS) Training Impact Assessment Framework is a structured and organized collection of beneficial PMIS training outcomes, focusing on recipients of benefits, and documented creator of benefits. The framework contains an assemblage of beneficial positive outcomes that are hypothesized to be created by PMIS training based on current literature and expert input.

To maximize the utility, universal applicability, and flexibility of research outcomes, the proposed framework does not prescribe evaluation methodologies or processes, specific measurement techniques, scales, or units of measure for use in evaluation. The framework as proposed includes the 172 unique benefits, the benefit source discipline, and whether the benefit is likely to be realized at the Individual, Workgroup, or Organizational levels. Scales to measure training outcomes, outcome measurement processes or evaluation methodologies are not included in the framework.

Figure 3: Divergent Radial Benefit Flow Observed



The benefits identified in each citation/quote were recorded. Each chronicled benefit was classified according to whether the benefit would likely apply primarily to individual

employees, project teams, or entire organizations. Coordinate intersections correspond to specific levels, source discipline, and area of improvement in the framework.

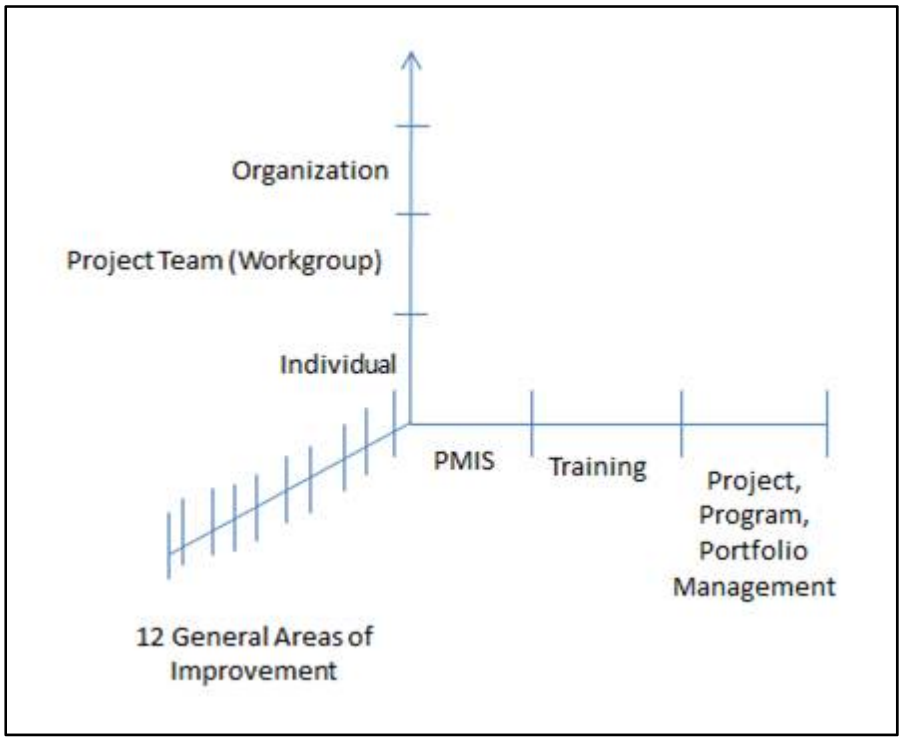


Figure 4: Framework Representation in Cartesian coordinates

The twelve high-level general areas of improvement and PMIS, Training, and PM are treated as categorical or nominal variables. Only Individual, Workgroup, and Organizational are treated as increasing (with an arrow extending from the axis). This fits

with the concept that individual training outcomes "roll up" to the project team and the organization, as exemplified by the following passages:

"Additionally, while enhanced learning may be considered an advantage to individual learners, individual-level learning outcomes in aggregate can have important implications for organizational-level outcomes." - (Granger & Levine, 2010)

"Vertical transfer refers to the upward propagation of individual-level training outcomes that emerge as team- and organizational-level outcomes." - (Salas & Cannon-Bowers, 2001)

4.4 Comprehensive Framework Element Composition

4.4.1 Accountability:

Value is delivered in the area of accountability in the areas of audits and regulations, delegation, improved transparency, and clarity of structures and roles.

Benefits to Individuals:

Use of a PMIS helps project managers to efficiently audit (Raymond & Bergeron, 2008). PMIS can send alerts and reminders to project resources (Rapport, 2009). PMIS software can also be used to clearly show responsibility for each task (Rapport, 2009).

Benefits to Workgroups:

Kaiser & Ahlemann suggest that the use of a PMIS provides benefits at the workgroup level through improved delegation and tracking of tasks (Kaiser & Ahlemann, 2010). Eskerod & Riis document tasks and responsibilities being known by team members in a timely fashion, and greater team member empowerment as benefits of project management (Eskerod & Riis, 2009).

Benefits to Organizations:

Using a PMIS (check) facilitates streamlined regulatory compliance for external audits and initiatives like Sarbanes-Oxley (Bednarz & Dubie, 2006; Kastel, 2009). PMIS software can also be used to clearly show responsibility for each task (Rapport, 2009). Project management software can be populated with templates for standard government reports (DOD, DOE, NASA), which helps organizations comply with reporting regulations (Kerzner, 2006). Using a PMIS as a central repository for project documentation allows organizations to create a complete audit trail, which can also lower risk during legal proceedings (Watkins, 2008). The implementation of project management creates intangible value by increasing transparency, elucidating structures and roles, promoting accountability, and improving regulatory compliance (J. Thomas & Mullaly, 2008). All four of the government organizations studied by Crawford & Helm (2009) reported that project management created improved accountability, transparency,

and support for compliance, including the promotion of effective and efficient management of public funds. The implementation of program management can promote transparent authority, accountability, and responsibility. Reyck et al. argue that PPM developed around the idea of promoting portfolio governance and accountability (Reyck et al., 2005). Furthermore, a large number of organizations studied by Reyck et al. implement accountability at the portfolio level. Project management has been implemented as a means of ensuring compliance with strict regulatory and audit trail requirements (Turner, Ledwith, & Kelly, 2010). Improved transparency, and clear roles and responsibilities have been documented as benefits of project management (Eskerod & Riis, 2009). Levine identifies regulatory compliance and increased staff accountability as benefits of PPM (Levine, 2005). Archiving all program-related documents at the end of the program lifecycle, in accordance with (Project Management Institute., 2008d), prepares an organization for future audits. Delegation of responsibility for the delivery of intermediate and final program benefits occur during benefits realization planning (Project Management Institute., 2008d). Executing the Plan for Audits process in accordance with (Project Management Institute., 2008d) facilitates compliance with organizational program management processes, and assures that the program is ready for internal or external auditing of finances, processes, and documentation. To prepare for risk events, high-priority program risks are assigned a risk owner, and resources are allocated to for the risk response (Project Management Institute., 2008d). The risk owner is accountable for management of the risk. He or she must verify that the risk is analyzed,

assign risk responses as required, and actively oversee the risk until it is no longer current. Implementing formal program management reinforces effective governance and accountability (Project Management Institute., 2008d). All government programs are subject to audit. Construction programs can be audited by the organization providing funding. Simply following the organization's approved program management processes will prepare the program to be audited (Project Management Institute., 2008d). Portfolio risks are assigned owners during the Develop Portfolio Risk Responses process (Project Management Institute., 2008c). Roles are defined, responsibilities are specified for all participants in the portfolio management process in the Portfolio Management Roles and Responsibilities Document (Project Management Institute., 2008c). By creating a single record of all project information and correspondence, PMIS software enhances the ability of the organization to audit the project record and trace changes (Project Management Software, 2006). Using a PMIS to manage projects improves accountability (Kastel, 2009).

4.4.2 **Attitude**

Value is delivered in the area of Attitude in the areas of reduced absenteeism, acceptance of technology, cross-cultural adjustment, morale, outcome expectancy, perceived anxiety, self-actualization, self-efficacy, commitment to objectives, employee buy-in, employee job satisfaction, motivation, and encouraged openness.

Benefits to Individuals:

Salespeople who participate in self-management training have been shown to exhibit higher levels of self-efficacy and outcome expectancy (Aguinis & Kraiger, 2009; Frayne & Geringer, 2000). Coaching is shown to improve coachee self-efficacy (Baron & Morin, 2009). Phillips suggests that training can be used to improve employee job satisfaction (J. Phillips, 1996). Gupta and Bostrom (2006) posit that one of the benefits of training is a reduction in perceived anxiety, which they characterize as "feelings of apprehension, tension or uneasiness in the outcomes of using a system". Nelson and Cheney (1987) show that training can be successfully used to improve end-user abilities with an information system. Training has been shown to improve employee self-actualization (Galanou & Priporas, 2009). The impact on trainee self-efficacy is one indicator of training effectiveness (Brown & McCracken, 2010). Training can improve self-efficacy (Tannenbaum & Yukl, 1992). The literature suggests that training can be an effective means of decreasing absenteeism (Bedwell & Salas, 2010). The literature suggests that training can improve training participant attitudes (Galanou & Priporas, 2009). Nelson & Cheney conclude that a there is a positive relationship between the computer-related ability of an end user, and the end user's acceptance of computer-related technologies (Nelson & Cheney, 1987).

Benefits to Workgroups:

Training of middle managers has been shown to improve team morale (Galanou & Priporas, 2009). Individuals who participate in training have also been shown to have improved levels of cross-cultural adjustment (Aguinis & Kraiger, 2009). Colquitt et. al's meta-analysis of training studies identifies declarative knowledge, task performance, and self-efficacy as the most frequently studied outcomes (Colquitt, LePine, & Noe, 2000; Yi & Davis, 2003). Wearne notes that project management education can increase motivation and improve project management competence in teams (Wearne, 2008).

Benefits to Organizations:

Training can provide accelerated adoption of technology and improve organizational morale (IBM, 2008b). Nelson and Cheney conclude that training can be successfully used to improve end-user abilities with an information system, and that improved end-user abilities facilitate user acceptance of the information system (Nelson & Cheney, 1987). Employing the principles of PPM to address potential project changes in a rational, timely, and objective manner encourages employee openness, employee buy-in, and enhances commitment to objectives (Levine, 2005). PPM facilitates improved employee motivation and buy-in because decisions are made by a governing body, using objective methods (Levine, 2005). PPM increases morale because employees who are responsible for the execution of projects are able to actively participate in the estimating

process (Levine, 2005). A realistic portfolio improves work-life balance, improved morale, improved productivity, reduced employee burnout, and reduced costs (Levine, 2005). Harris suggests that training can improve morale (Harris, 1995).

Phillips suggests that training can be used to reduce employee absenteeism (J. Phillips, 1996). Salas also suggests that training effectiveness can be assessed using absenteeism rates (Bedwell & Salas, 2010; E Salas, Burgess, & Cannon-Bowers, 1995). Bulut and Culha identify reduced absenteeism as a benefit of training (Bulut & Culha, 2010). Effective training can lower absenteeism (Facteau, et al., 1995). Philips suggests that training can reduce employee absenteeism, tardiness, improve the organizational work climate, reduce employee grievances, reduce employee turnover, improve job satisfaction, improve employee loyalty, employees' self-confidence, improve decision making, improve problem solving, avoid conflicts (J. Phillips, 1996).

4.4.3 **Communication & Collaboration**

Value is delivered in the area of Communication and Collaboration in the areas of conflict management, improved teamwork, task coordination, and enhanced collaboration and communication.

Benefits to Individuals:

Training is shown in the literature to improve cross-cultural adjustment (Aguinis & Kraiger, 2009). Training is shown in the literature to improve self-efficacy (Aguinis & Kraiger, 2009). Training is shown in the literature to improve one's subjective appraisal of job performance (Aguinis & Kraiger, 2009). Training is shown in the literature to improve object performance outcomes (Aguinis & Kraiger, 2009). Training can be successfully to facilitate cross-cultural adjustment (Tannenbaum & Yukl, 1992).

Benefits to Workgroups:

When PMIS software is used to support collaboration, users can work more effectively work together (Visitacion & DeGennaro, 2009). Kaiser & Ahlemann indicate that the use of a PMIS can facilitate communication within project teams (Kaiser & Ahlemann, 2010). Advances in PMIS technology and business system integration promote improved project team collaboration and communication (Callaghan, 2003). Using a PMIS and the internet facilitates quick communication with project team members stakeholders, regardless of location (Mantel, 2005).

Trainees working on an interdependent command and control simulator who were given generic teamwork skills training showed improved communication, better planning, collaborative problem solving, improved task coordination, and declarative knowledge (Aguinis & Kraiger, 2009; Ellis, Bell, Ployhart, Hollenbeck, & Ilgen, 2005).

Training is shown in the literature to provide knowledge of teamwork principles, and improved team communication and performance (Aguinis & Kraiger, 2009). Clarke found that training produced improvements in "the self-assessed project management competences of teamwork and managing conflict" (Clarke, 2010). Galanou & Priporas (2009) found that training of middle managers improved their ability to avoid disagreements and complaints from subordinates. Training recipients exhibit increased teamwork behaviors, communication, and more effective team performance (Eduardo Salas & Cannon-Bowers, 2001). Training is documented as contributing to team building and improving communication skills within a team environment (Tannenbaum & Yukl, 1992).

Training is shown in the literature to improve cross-cultural adjustment (Aguinis & Kraiger, 2009). Training is shown in the literature to improve communication and teamwork. (Aguinis & Kraiger, 2009). Training is shown in the literature to improve task coordination in teams (Aguinis & Kraiger, 2009). Training is shown in the literature to improve planning within teams (Aguinis & Kraiger, 2009). Training is shown in the literature to improve collaborative problem solving within teams (Aguinis & Kraiger, 2009). Training has been shown to contribute to team building (Tannenbaum & Yukl, 1992).

Benefits to Organizations:

Research has indicated that one of the principal uses of project management software is for communication (Herroelen, 2005). PPM facilitates improved communication at the organizational level because decision making criteria and governance are clear, and decisions can be made using objective methods (Levine, 2005). A PMIS can be configured to provide stakeholder with reports that have been customized for their needs (Mantel, 2005).

Organizations can improve collaboration by utilizing PMIS technology to manage and share important project information and updates (Project Management Software, 2006).

Organizations can deploy commercial-off-the-shelf project management software to support improved communication and collaboration between owners, general contractors, architects, engineers, and subcontractors (Project Management Software, 2006). Use of a PMIS for reporting allows a project manager to quickly communicate progress and performance data to stakeholders (Project Management Institute., 2008a). Contractors can use PMIS technology to send bid invitations electronically to subcontractors and vendors (Feldman & Feldman, 2005).

New capabilities are being incorporated into PMIS software to support collaboration between employees, contractors, partners, and customers (Kastel, 2009). Improved communication and collaboration at the organizational level are documented as benefits of implementing project management (J. Thomas & Mullaly, 2008). Effective

communications are documented as a benefit of program management (Pellegrinelli, Partington, Hemingway, Mohdzain, & Shah, 2007). PPM is documented to provide improved communications and alignment between IT and business leaders (Reyck, et al., 2005). The implementation of project management is documented to create value through improved communication (J. L. Thomas & Mullaly, 2009). An organization's project management implementation can be leveraged specifically to support team building (Turner, et al., 2010). Standardized project management provides improved communication efficiency between the organization and clients, and therefore permits clients to experience a more cooperative and collaborative relationship with the contractor (Zhai, Xin, & Cheng, 2009). Project management facilitates improved collaborative ability between organizations. This promotes the development of long-term strategic partnerships with subcontractors and suppliers (Zhai, et al., 2009).

A structured approach to project management helps in interfacing directly with stakeholders and avoiding conflict (Zhai, et al., 2009). Using a standardized project management model as a common frame of reference simplifies internal and external communications (Eskerod & Riis, 2009). Implementing project management has been shown to generate a common dialect and introduce common project management concepts (Andersen & Vaagaasar, 2009). Salas & Cannon-Bowers suggest that training can be used to improve communication (Eduardo Salas & Cannon-Bowers, 2001) Implementing PPM effectively will contribute to increased communication at all levels of

the organization (Levine, 2005). Effective training programs may reduce absenteeism and reduce employee turnover (Bulut & Culha, 2010).

4.4.4 Cost/Time

Benefits to Individuals:

Kaiser and Ahlemann (2010) suggest that utilization of a PMIS helps individuals to save time when completing tasks. Project calendars help project managers schedule activities based on the availability of resources (Kerzner, 2006). PMIS software improves cost control by helping to develop realistic cost plans before work is started, and to aid in the control of project costs during project execution (Kerzner, 2006). Calendars provide benefits in scheduling, tracking equipment, documenting project delays (Feldman & Feldman, 2005). Calendars can be utilized at the global, project, and resource level (Tombros & Mohan, 2008).

Benefits to Workgroups:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Organizations:

Raymond & Bergeron found that use of a PMIS by project managers improves budget control, contributes to meeting project deadlines, and positively impacts project success (Raymond & Bergeron, 2008). A realistic portfolio provides reduced costs (Levine, 2005). In interviews and surveys conducted by Forrester Research, PPM tool users estimated that their rates of cost overruns decreased by 10% (Symons, 2009). Furthermore, PPM users estimated that their project throughput time decreased by 10% (Symons, 2009). Kaiser & Ahlemann suggest that one of the benefits made available by using a PMIS is decreased time-to-market (Kaiser & Ahlemann, 2010). PMIS software improves scheduling by arranging project activities to minimize duration and optimize resource utilization (Project Management Institute., 2008a). Using PMIS software to automate the scheduling process accelerates project scheduling (Project Management Institute., 2008a). The estimating capabilities of some PMIS applications simplify cost estimating and permit rapid consideration of alternative cost estimates (Project Management Institute., 2008a). PMIS software further aids in scheduling by allowing resources to enter revised time estimates and completion information and automatically recalculating the schedule (Kerzner, 2006). Project management software provides an efficient means of planning projects, including scheduling, labor, equipment, materials, and budget in the most beneficial way possible (Feldman, 2007). Using the computer

algorithm to schedule improves scheduling by providing optimized schedules, subject to resource availability constraints (Lawton, 2000).

By submitting payment information to the general contractor using the PMIS, the time it takes to pay subcontractors can be reduced (Setzer & Bonafair, 2004). Implementing a PMIS reduces cost by eliminating the need to enter data multiple times and reconcile data, reducing IT support infrastructure, eliminating IT interfaces, reducing procurement costs, improved decision making, and overall streamlining of operations (Kastel, 2009). Readily available and easily accessible historical project data available enhances planning and improves the quality of estimates (Kastel, 2009). Centralized project financial data improves cash flow control and treasury functions, and allows overhead costs to be allocated to projects in more detail, improving cost control accuracy (Kastel, 2009). Corporate budget and cost control practices can be used to improve project cost control (Kastel, 2009). Training has been connected with increased organizational effectiveness and profitability (Aguinis & Kraiger, 2009). Training can provide measurable return on investment by increasing revenue generated, improving productivity and performance, and reducing costs (IBM, 2008b). Philips suggests that training can reduce costs (J. Phillips, 1996).

4.4.5 Effectiveness and Efficiency

Benefits to Individuals:

Raymond and Bergeron (Raymond & Bergeron, 2008) found that using a PMIS improves the productivity, effectiveness, and efficiency of project managers at planning, scheduling, monitoring, and control activities. It was also found that using a PMIS improves decision making time (Raymond & Bergeron, 2008). Because project managers can automate administrative processes such as data collection and report generation, the amount of time a manager spends on administrative time decreases. Organizations contacted by Forrester research estimated that administrative time spent by managers decreased by 25% (Symons, 2009). Ali, Anbari, & Money concluded that using project management software enhances the effectiveness and efficiency of project professionals and positively impacts the results of their projects (Ali, et al., 2008).

Training is shown in the literature to improve both technical skills and computer skills (Aguinis & Kraiger, 2009). Training is shown in the literature to improve job performance (Aguinis & Kraiger, 2009). Great reliance can be placed on training as a critical means to improve skills and capabilities (Ayas, 1996). Bohlen & Ferratt (1993) conclude that training can increase the efficiency of users at performing tasks on a computer, so that tasks are accomplished in less time and/or with fewer keystrokes required. Training has been shown to be an effective method to increase software skills (Coppola & Myre, 2002). Training can be used to enhance individual skills and competencies (Galanou & Priporas, 2009). Training has been shown to enhance job

specific skills and job performance (Land, Tan, & Bin, 2005). Michel et al., demonstrated that training increases effectiveness and efficiency in airport x-ray security screeners (Michel et al., 2007, October).

Nelson & Cheney (1987) conclude that there is positive relationship between the computer-related training an individual receives and the individual's computer-related ability. Philips (1996) suggests that training can teach new skills. Training can be successfully to use enhance skills and improve job performance (Tannenbaum & Yukl, 1992). Yi & Davis (2003) suggest that training has a positive impact on trainee task performance.

Benefits to Workgroups:

Kaiser & Ahlemann (2010) suggest that utilization of a PMIS can provide benefits at the workgroup level by improving the efficiency of meetings. Web-based project management software allows team members to enter updated project data remotely, eliminating the need for a superintendent to collect reports individually from team members, or for workers to report to a field office to provide the data (Feldman & Feldman, 2005). Training is shown in the literature to improve planning (Aguinis & Kraiger, 2009). Atkins & Gilbert conclude that training can significantly contribute to project efficiency (2003).

Benefits to Organizations:

A realistic portfolio improves productivity (Levine, 2005). Single data entry and information sharing streamline administrative activities (Project Management Software, 2006). The literature suggests that training can be an effective means of increasing quantity output (Bedwell & Salas, 2010). The literature suggests that training increases organizational productivity (Dearden, Reed, & Van Reenen, 2000). Training is one of the most widely used methods for improving individual productivity (Galanou & Priporas, 2009).

4.4.6 Knowledge Management

Value is delivered in the area of Knowledge Management in the areas of analysis, decision making, declarative knowledge, documentation management, ease of access, information flow, innovation, knowledge outcomes, lessons-learned feedback, problem solving, procedural knowledge, project management competence, strategic knowledge, templates, innovation, and information availability in real-time.

Benefits to Individuals:

Kaiser and Ahlemann suggest that utilization of a PMIS helps improve decision making in individuals when completing tasks by drawing their attention to important information (2010). Report templates help project managers by automating data collection, analysis,

and reporting (Kerzner, 2006). Integrated PMIS provides benefits at the individual level by reducing the need for project managers to enter data into disparate systems (Lawton, 2000). The ability to sort project activities based on user-specified input facilitates analysis and decision making (Kerzner, 2006). Project field personnel can easily provide updated progress data by logging on remotely (Lawton, 2000). Project management software improves scheduling by drawing the users attention to potential conflicts (Lawton, 2000). Critical path analysis and the calculating of multiple float paths improves analysis (Tombros & Mohan, 2008). Using a PMIS increases reporting and analysis capabilities by allowing users to drill-down into reports to view high-level organizational data, all the way to detailed project expenditures (Kastel, 2009).

Training is shown in the literature to improve innovation (Aguinis & Kraiger, 2009). Employee knowledge can be increased as a benefit of training (Harris, 1995). Training may enhance strategic knowledge, which is defined as "knowing when to apply a specific knowledge or skill" (Aguinis & Kraiger, 2009). Training is shown to improve creative productivity in managers (Galanou & Priporas, 2009). Training is shown in the literature to positively impact manager knowledge outcomes and expertise/behavioral outcomes (Aguinis & Kraiger, 2009).

McCreery (2003) concluded that as a group, training increased levels of project management knowledge and improved abilities to apply that knowledge. Mengel found that a course on leadership and project outcomes increased leadership and project

management competencies in undergraduates (2008). Specifically, students were better able to (1) initiate and plan a project, and to (2) execute, control, and close a project (Mengel, 2008). A meta-analysis by Sitzmann, Kraiger, Stewart, & Wisher (2006) indicates that training is used to increase declarative knowledge. Wouters, Paas, & van Merriënboer (2008) suggest that training can be used to improve problem solving.

Benefits to Workgroups:

Important project documentation like change requests and RFIs is immediately available to all authorized users (Project Management Software, 2006). PMIS software can provide current and complete customer service and equipment history to on-site personnel (Feldman, 2007). Project team members can utilize PMIS software to drill down to lower levels of detail, and can also create different views of reported data (Watkins, 2008). Training is shown in the literature to improve knowledge of teamwork principles (Aguinis & Kraiger, 2009). Training is shown in the literature to improve declarative knowledge within teams (Aguinis & Kraiger, 2009).

Benefits to Organizations:

Employing the principles of PPM to address potential project changes in a rational, timely, and objective manner encourages problem solving (Levine, 2005). As

organizations accumulate past project experiences in a central platform, they can incorporate lessons learned from past projects and identify areas to target for improvement. Use of a PMIS for reporting can provide executives with a unified view of ongoing projects (Bednarz & Dubie, 2006). Archived project templates simplify and improve planning of future projects that are similar to past engagements (Rapport, 2009). Kaiser & Ahlemann suggest that organizations that utilize a PMIS create better products (2010). Kaiser & Ahlemann suggest that one of the benefits made available at the organizational level by using a PMIS is increased efficiency (2010). Use of a PMIS allows organizations to organize and protect valuable project information through check-in, check-out, version control (Callaghan, 2003). Reporting is more accurate because reports are generated using data from a singular, shared database of record (Project Management Software, 2006). Use of a PMIS improves information flow by making all important information available to authorized users immediately (Project Management Software, 2006). Data commonly made available to users includes submittals, change requests, RFIs, daily logs, communications, budgeted costs, actual costs, committed costs, vendor information, materials information, bidding information, purchase orders, start dates, retainage, payment terms, contact information (Project Management Software, 2006). Estimating, marketing, customer relationship management, accounting, maintenance management, and service management can be packaged into one commercially available tool (Project Management Institute., 2008a). Organizations can enhance analysis by using PMIS software to track actual dates versus planned dates and

forecasting the effects of changes to project schedules (Project Management Institute., 2008a). Using a PMIS to monitor earned value assists in decision making (Kerzner, 2006).

Utilizing lessons learned from a PMIS allows organizations improve estimating for future projects, improve business processes, identify aspects of the project that were done correctly, and identify aspects of the project for improvement next time (Kerzner, 2006). Project management software improves information flow and allows all resources to make decisions with the same data (Feldman & Feldman, 2005). Standard templates can be quickly customized (Feldman & Feldman, 2005). Project documentation can be housed in a single, centralized location (Feldman & Feldman, 2005). If a typical type of activity consistently takes longer than expected, the project management software can be configured to estimate the duration of an activity based on the longer time (Lawton, 2000).

Communication of project management software with accounting systems streamlines information flow and eliminates the need for data to be re-entered (Setzer & Bonafair, 2004). By using wireless connections and entering inspection data directly into project management software, the inspection process can be streamlined since the results can be instantaneously uploaded directly from the inspection site (Setzer & Bonafair, 2004).

PMIS software provides increased visibility into the management of projects (Visitacion & DeGennaro, 2009). PMIS software also helps organizations manage project

requirements (Visitacion & DeGennaro, 2009). PMIS software can improve executive visibility into the cost and impact of projects as investments (Visitacion & DeGennaro, 2009).

Using PMIS software to manage all projects, programs, and facilities in one system allows organizations to evaluate portfolio performance using the most current data and to identify problems with significant time to intervene, which reduces risk and improves aggregated project performance (Watkins, 2008). Project management software enables users to view data in multiple formats and allows "what-if" analysis (Mantel, 2005). "What if" analysis allows organizations to analyze scenarios, and select the most appropriate approach to achieve the desired results (Kastel, 2009). Using the internet with project management software allows project data to be available on-demand to participants all over the world, which improves stakeholder management, communication and collaboration, and monitoring (Mantel, 2005). The rapid, more complete flow of information leads to improved decision making (Kastel, 2009). Readily available and easily accessible historical project data available improves the consistency of project outcomes (Kastel, 2009). Utilizing a PMIS can provide benefits such as being able to retrieve more, higher quality information faster (Kastel, 2009). Templates generated from prior projects improve planning by making it easier (Kastel, 2009). Project management software facilitates "what if" analysis (Kastel, 2009). PPM tools improve analysis and decision making by providing advanced analysis tools and capabilities such as Analytical

Hierarchy Process (AHP), resource allocation algorithms, financial analysis and ROI tools, pivot tables, dashboards, bubble charts, and risk-reward analysis capabilities (Levine, 2005).

PPM tools objectively prioritize projects based on mathematically calculated business value, assist the organization in optimizing the project portfolio based on budget and resource limitations, facilitate communication and collaboration, provide reporting capabilities that help locate areas of underperformance, and create graphics and reports that convey essential information in an easy to understand format (Levine, 2005).

Philips suggests that training can improve problem solving and decision making (J. Phillips, 1996).

4.4.7 Market Presence

Value is delivered in the area of Market Presence in the areas of competitive advantage, organizational reputation and visibility, sales, new market development, expansion of customer base, opportunity identification, and increased market share.

Benefits to Individuals:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Workgroups:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Organizations:

Organizations can use online communities created by PMIS software to post bid information and updates, send bid invitations, get information about projects that are available for bidding, and to enhance their market visibility (Project Management Software, 2006). Contractors can use virtual communities to increase market visibility by promoting their services directly to companies that require specific services (Feldman & Feldman, 2005). The rapid, more complete flow of information improves organizational competitiveness (Kastel, 2009). Research suggests that training programs can influence an organization's reputation (Aguinis & Kraiger, 2009). Training is viewed as a means of improving competitive advantage because of the ability of training to improve individual productivity and positively impact business objectives (Galanou & Priporas, 2009).

Sales can be increased as a benefit of training (Harris, 1995). Indeed, training has been shown to be related to improved selling effectiveness (Leach & Liu, 2003).

4.4.8 Strategic and Enterprise

Benefits to Individuals:

Kaiser and Ahlemann (2010) suggest that utilization of a PMIS benefits individuals by and enhancing their performance with respect to project management roles and increasing their control over PM processes. Empirical studies indicate that executive coaching improves leadership and performance (Baron & Morin, 2009).

Benefits to Workgroups:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Organizations:

Employing the principles of PPM to address potential project changes in a rational, timely, and objective manner encourages problem solving, employee openness, and enhances commitment to objectives (Levine, 2005). Employing a PMIS can support a process framework that helps ensure that projects are selected, planned, performed, and reviewed consistently across the organization and in accordance with organizational policies (Bednarz & Dubie, 2006). A realistic portfolio improves work-life balance (Levine, 2005). Visibility into project performance and resource planning across an

organization enhances multi-project management, pipeline analysis, and forecasting (Bednarz & Dubie, 2006). Features such as standardized project scorecards and business cases improve decision making and project selection (Symons, 2009). Kaiser & Ahlemann suggest that utilizing a PMIS allows organizations to achieve goals faster and more comprehensively (2010). Analysis capabilities are improved by automating "what if" analysis (Kerzner, 2006). Interviews and a survey of PPM tool users found that users typically identify about 10% of their projects as low-value or unnecessary (Symons, 2009). Use of a PMIS allows organizations to improve, enforce, and automate project management processes (Project Management Software, 2006). Some PMIS software comes standard with integrated estimating, accounting, procurement, and inventory management functionalities (Project Management Software, 2006). Included templates and automated business processes can dramatically accelerate project planning (Project Management Software, 2006). Multi-project management is enhanced by using a single, comprehensive database that simplifies planning, analysis and reporting across multiple projects (Kerzner, 2006). Project management software enhances multi-project management by allowing organizations to identify and focus on priorities (Lawton, 2000).

Higher standardization of project management toolsets may contribute to project success (Milosevic & Patanakul, 2005). Higher standardization of process may also contribute to project success (Milosevic & Patanakul, 2005). Project management software can be used

to help improve business processes (Visitacion & DeGennaro, 2009). Project management software use supports business processes (Setzer & Bonafair, 2004). PMIS software can to enhance strategic decision support and the connection between business strategy and execution (Visitacion & DeGennaro, 2009). PMIS software can enhance project, program, portfolio, and strategic planning capabilities (Visitacion & DeGennaro, 2009). Organizations report using PMIS software for generating new ideas, tracking defects, and service management (Visitacion & DeGennaro, 2009). Automating processes helps to eliminate inconsistent business processes and ensure standard, repeatable processes across the organization (Watkins, 2008). Resource usage can be planned across multiple projects (Mantel, 2005).

Centralized data allows fast reporting of project financials to stakeholders (Kastel, 2009). Project accounting practices can be improved by charging actuals to projects through receipts, movement of project stock, or by internal allocation (Kastel, 2009). Project management software can be used to enforce standards and business processes across the organization (Kastel, 2009). Business processes may be enforced and improved by the PMIS, for example, the charging of time against a project may only be permitted after a project has passed a predetermined stage (Kastel, 2009). When a project is formally approved, the project can become authorized to collect costs (Kastel, 2009). A project may be created in the PMIS as the result of a sale to a client. In this case, as deliverables are completed, the client can be billed (Kastel, 2009). When maintenance projects are

planned, they can refer specifically to procedures defined in an integrated maintenance management system (Kastel, 2009). Several PPM tools focus on governance (Levine, 2005). PMIS software can be used to help outline strategic objectives and map projects to objectives (Levine, 2005). Salas & Cannon-Bowers suggest that training can be used to increase organizational effectiveness (Eduardo Salas & Cannon-Bowers, 2001). Training has been shown to contribute to improvements in culture (Tannenbaum & Yukl, 1992).

4.4.9 Performance

Benefits to Individuals:

Individual project managers and resources benefit from having impact analysis, early warning capabilities, data management and reporting, multi-project tracking, critical path analysis, graphical reporting tools, stored report templates, resource and cost analysis tools at their fingertips (Kerzner, 2006). Integrated planning, tracking, and monitoring capabilities help project managers perform the tasks associated with managing project performance (Kerzner, 2006). PMIS helps project managers by improving reporting. A user can request reports in standard formats, or user-defined formats. Standard government reports (DOD, NASA, DOE, etc.) can be generated quickly (Kerzner, 2006). Using project management software allowed project professionals to implement a higher-level of control over their projects and contributes to project success (Ali, et al., 2008).

Individual performance is well documented in the literature as being improved as the effect of training (Aguinis & Kraiger, 2009).

Benefits to Workgroups:

Training is shown in the literature to improve the performance of teams (Aguinis & Kraiger, 2009).

Benefits to Organizations:

Raymond & Bergeron found that use of a PMIS by project managers contributes to the satisfaction of project technical specifications and contributes to increased quality of the work of project managers (2008). Interviews and a survey and conducted by Forrester Research indicate that PPM tool use can be expected to cause the rate of project failure to decrease by approximately 15% (Symons, 2009). Using a PMIS to track earned value helps identify underperforming projects (Symons, 2009). Kaiser & Ahlemann suggest that one of the benefits made available by using a PMIS is increased revenue (Kaiser & Ahlemann, 2010). PMIS software improves analysis and reporting by tracking EVM components BCWP, BCWS, ACWP, and ACWS, automating trend analysis, and helping to forecast project results (Project Management Institute., 2008a). Project management software is beneficial in developing schedule modifications when actual performance is

less than planned performance (Feldman, 2007). Keeping all project documentation in a singular location facilitates change management and tracking and auditing of changes (Watkins, 2008). Project management software facilitates project management techniques such as critical chain management (Mantel, 2005). Specialized project management software packages produce reports that draw management attention on problem areas (Mantel, 2005).

PMIS tools support critical chain management (Levine, 2005). EVM data is calculated within the PMIS, and the data is provided to the governance council (Levine, 2005). Scheduling software allows management to capture the project plan at a given time as the approved baseline for the project and compare later versions of the plan with the baseline to locate and measure variances and trends (Project Management Institute., 2011). Scheduling software allows management to perform "what if" analysis (Project Management Institute., 2011).

Research suggests that training programs can positively impact organizational financial performance (Aguinis & Kraiger, 2009). Many studies indicate the benefits that training creates at the organizational level (Aguinis & Kraiger, 2009). Research suggests that training can improve organizational performance in the areas of improved profitability, organizational effectiveness, and productivity (Aguinis & Kraiger, 2009). Research suggests that training can improve organizational performance in the areas of improved reduced costs and improved quality (Aguinis & Kraiger, 2009). Research suggests that

training can improve organizational performance in the areas of employee turnover and organizational reputation (Aguinis & Kraiger, 2009). The literature suggests that training can be an effective means of increasing quality (Bedwell & Salas, 2010). Training may be used to improve work quality (Galanou & Priporas, 2009). Training can improve organizational output and performance, tasks completed, improve quality and reduce rework, and reduce the time required to complete projects, and increase the number of successfully completed projects (J. Phillips, 1996).

Philips suggests that training can improve output, tasks completed, quality, rework, equipment downtime, employee overtime, time to complete projects, employee absenteeism, tardiness, work climate, employee grievances, employee turnover, job satisfaction, employee loyalty, employees' self-confidence, employees' perceptions of job responsibilities, perceived changes in performance, new skills, decisions made, problem solving, conflicts avoided, frequency in use of new skills successful completion of projects (J. Phillips, 1996). Yong-Kean & Teck-Hong (2010) suggest that training can positively significantly impact organizational performance.

4.4.10 Resource Management

Benefits to Individuals:

Kaiser and Ahlemann suggest that utilization of a PMIS helps individuals to improve resource utilization during task execution (2010).

Benefits to Workgroups:

Data can be gathered and reports prepared without lengthy phone conversations or meetings (Mantel, 2005).

Benefits to Organizations:

PMIS software can be used to assist in planning, organizing, managing, and optimizing resource utilization (Project Management Institute., 2008a). Organizations can use virtual "plan rooms" to post projects for bid, upload drawings, specifications, and other relevant data, all of which lead to improvements in procurement (Feldman & Feldman, 2005). Resource-leveling capabilities allow organizations to compare the outcomes of implementing various resource allocation priority rules (Mantel, 2005). The costs of adding additional resources can be compared with late delivery costs, or delay costs if additional resources are not added (Mantel, 2005). Organizations can buy for projects across the organization, which reduces costs through economies of scale (Kastel, 2009).

Materials management and planning ensure that materials are available when required (Kastel, 2009). Internal and external labor sources can be managed independently (Kastel, 2009). The management of specialized equipment and tools can be improved since sometimes the equipment will need to be procured, and equipment and tools have a limited capacity, and their use should be coordinated and scheduled (Kastel, 2009). Using a PMIS can simplify materials management (Kastel, 2009). Integrated materials management systems can provide material descriptions, unique identification numbers, information on required physical condition, preferred vendors, method of delivery (Kastel, 2009). Using a PMIS can simplify and improve contract and contractor management (Kastel, 2009). Using a PMIS with integrated supply chain benefits bidding activities and purchasing can be performed electronically and materials may be stored until ready for use (Kastel, 2009). Sophisticated PMIS systems can handle multiple currencies on the same project (Kastel, 2009). PMIS software can also improve capacity planning by calculating organizational capacity subject to the project pipeline and resource availability (Levine, 2005). Project scheduling tools improve resource management by allowing management to optimize scheduling based on resource availability, assign priorities to activities that require the same resources at a given time (Project Management Institute., 2011). By using training to help standardize IT policies, organizations can reduce IT resource usage and costs (IBM, 2008b). Phillips (J. Phillips, 1996) suggests that training can reduce equipment downtime and reduce employee overtime

4.4.11 Risk

Benefits to Individuals:

Wearne (2008) notes that project management education can improve risk management competencies.

Benefits to Workgroups:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Organizations:

Using a PMIS improves risk management by storing all current and historic information related to project risks, including qualitative and quantitative risk analysis documentation, and risk-related reports (Kerzner, 2006). Use of software for risk management improves analysis, tracking, and control of project risks (Raz & Michael, 2001). Project management software automates the calculations required to use probabilistic networks (Mantel, 2005). Utilizing a PMIS can reduce risk (Kastel, 2009). Project management software can be used to manage risk (Kastel, 2009). Risk values can be generated in a specialized risk management tool and imported into PPM software (Levine, 2005). Risk management is improved by PMIS by incorporating probabilistic networks and simulation into planning, or by aiding management in identifying, analyzing, and actively managing risks (Levine, 2005).

4.4.12 Stakeholder Management

Benefits to Individuals:

Research suggests that training programs can increase employee satisfaction (Aguinis & Kraiger, 2009). Employee morale can be increased as a benefit of training (Harris, 1995).

Benefits to Workgroups:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Organizations:

Effective stakeholder engagement is documented as a benefit of program management (Pellegrinelli, et al., 2007). Implementation of PMIS toolsets may lead to increases in customer satisfaction (Kaiser & Ahlemann, 2010). Project management software can be used to provide up-to-date customer service records for on-site project personnel (Feldman, 2007). Integrated geolocation tracking can improve resource management by monitoring current equipment status at all times (Feldman, 2007). PMIS software can eliminate the need to enter data more than once, and can also eliminate paper-based files and approval processes (Watkins, 2008). Electronic project groups can be created that

allow stakeholders to receive up-to-date information on resource usage, task completion, and overall project status (Mantel, 2005).

CRM and opportunities management software can be integrated with PMIS (Levine, 2005). Research suggests that training programs can increase customer and owner/shareholder satisfaction (Aguinis & Kraiger, 2009). Research suggests that training can increase organizational commitment in employees (Bulut & Culha, 2010). Employees may perceive training as an indication that the organization values them and is willing to invest in them (Bulut & Culha, 2010). From the perspective of management, training is expected to provide benefits such as improved employee performance, increased productivity, decreased mistakes, and improved quality (Bulut & Culha, 2010).

From the perspective of management, effective training provides organizational benefits including improved employee performance, increased productivity, decreased mistakes, and improved quality, stronger emotional attachment to the organization, increased desire to stay within the organization, increased identification with the organization, and greater involvement in all facets of their jobs (Bulut & Culha, 2010). Training is one of the most widely used methods for communicating organizational goals to personnel (Galanou & Priporas, 2009). Customer service can be increased as a benefit of training (Harris, 1995). Training is shown to improve the organizational commitment of managers (Galanou & Priporas, 2009). Training can reduce employee turnover (IBM, 2008b). Training has been

shown to be related to improved organizational commitment and customer relations (Leach & Liu, 2003).

Paradise documents cases where organizations have used training to successfully improve customer satisfaction (Paradise, 2008). Organizations can use improved availability of training and ease of access to training to increase employee satisfaction and retention (Paradise, 2008). Organizations can improve customer service and relations by using training to move the organization to a customer-focused culture (Paradise & Patel, 2009). Organizations have credited training initiatives with increasing sales, profitability, and revenue (Paradise, 2008). Organizations can use training to keep highly-engaged employees satisfied and increase their desire to stay with the organization (Paradise & Patel, 2009). Training can increase organizational commitment (Tannenbaum & Yukl, 1992).

CHAPTER 5: PROJECT MANAGEMENT INFORMATION SYSTEM TRAINING INDUSTRY SURVEY

5.1 Survey Instrument Development

To identify the benefits that occur most often in practice as a result of PMIS training, an expert questionnaire was developed to send to experienced practitioners. The literature revealed an abundance of positive, beneficial outcomes being realized by individuals, project teams, and at the organizational level. Despite significant effort to combine similar benefits, the results of the analysis indicated the possibility of 172 unique beneficial positive outcomes of PMIS training. As a means of objectively selecting a limited number of elements for further analysis, the expert evaluations were totaled, and the elements of the framework that received the highest aggregate expert scores (indicating a strong belief of frequent occurrence) have been coded into the survey.

Expert input from a panel of 9 practitioners averaging 16.7 years of practice related to PM and 15.1 years of PM software use was used to objectively select a small number of the best-scoring elements of the proposed framework for inclusion in this survey.

To facilitate a simple and secure survey respondent experience and easy data collection/statistical analysis, a brief web-based survey was selected as the most appropriate data collection technique. After an analysis of web-based survey tools, surveygizmo.com was selected to host the survey. Current survey and statistical analysis literature was utilized extensively in the creation of the survey.

5.2 Factors Considered in Research

Table 9: Factors Examined in Research

No.	Factors Considered in Research	Variable Levels
1	Number of Years of Experience: In Project Management	Free response. Whole years.
2	Number of Years of Experience: Using PM Software	Free response. Whole years.
3	Number of Projects Managed Simultaneously	Multiple Choice (pick one). Five levels + Not Sure/Don't Know. 1 project 2-3 projects 4-5 projects 6-10 projects 10 or more projects
4	Typical Project Duration	Multiple Choice (pick one). Five levels + Not Sure/Don't Know. Less than 6 months 6 months to 1 year 1 year to 2 years 3-5 years 6 or more years Not Sure/Don't Know
5	Typical Project Size	Multiple Choice (pick one). 5 Levels + Not Sure/Don't Know: 1-5 FTE's 6-20 FTE's 21-50 FTEs 51-100 FTE's 100+ FTE's Don't know/Not sure
6	Project Complexity	7 Item Likert-Type scale. Not Complex to Very Complex.

Table 9: Factors Examined in Research

No.	Factors Considered in Research	Variable Levels
7	Primary Role	Multiple Choice (pick one). 13 + 1 narrative field to define Other role Executive Leadership Director of PM/PMO Portfolio Manager Program Manager Project Manager Scheduling Professional PM Specialist Functional Manager PM Consultant Educator/Trainer Researcher Project Contributor (i.e. Engineer, etc.) Other - If Used, Please Define Below (Optional) Other Role: _____
8	Industry Focus	Multiple Choice (pick one). 17 + 1 narrative field to define Other role Aerospace Automotive Construction Consulting Energy (gas, electric, oil) Financial Services Food and Beverage Government Healthcare Information Technology Legal Manufacturing Mining Pharmaceutical Telecom Training/Education
9	Does organizational unit use PM software to manage projects?	Multiple Choice (pick one). Two Items “Yes” or “No”

Table 9: Factors Examined in Research

No.	Factors Considered in Research	Variable Levels
10	How long has Org. Unit used PM software to manage projects?	Multiple Choice (pick one). Five levels + Not Sure/Don't Know. Less than 6 months 6 months to 1 year 1 year to 2 years 3-5 years 6 or more years Not Sure/Don't Know
11	Training Delivery Method	Multiple Choice (pick multiple). 7 Levels Onsite or Offsite Classroom Training Web-Based Training "Lunch and Learn" Style Training Sessions. Coaching and Mentoring Conference Attendance Participation in professional organizations that conduct events on project management toolset usage Identical Software with Practice Data to Simulate Real Use
12	Number of hours completed	7 Levels – Each is Free-Response. The 7 levels correspond (one-to-one) with the 7 delivery methods listed above.
13a	Self-Assessed Skill Level - Current	8 Levels (7 Item Likert-Type) + Not Sure/Don't Know "Poor" to "Excellent"
13b	Self-Assessed Skill Level – One Year Ago	8 Levels (7 Item Likert-Type) + Not Sure/Don't Know "Poor" to "Excellent"
13c	Self-Assessed Skill Level – Impact in the Past Year	8 Levels (7 Likert-Type) + Not Sure/Don't Know "No Improvement" to "Greatly Improved"
14a	Reporting of project, program, and portfolio data; Current Self-Assessment of	8 Levels (7 Item Likert-Type) + Not Sure/Don't Know "Poor" to "Excellent"
14b	Reporting of project, program, and portfolio data; One Year Ago	8 Levels (7 Item Likert-Type) + Not Sure/Don't Know "Poor" to "Excellent"
14c	Reporting of project, program, and portfolio data; Impact of delivery method in the Past Year	8 Levels (7 Likert-Type) + Not Sure/Don't Know "No Improvement" to "Greatly Improved"
15a	Management of multiple projects and programs; Current Self-Assessment of	8 Levels (7 Item Likert-Type) + Not Sure/Don't Know

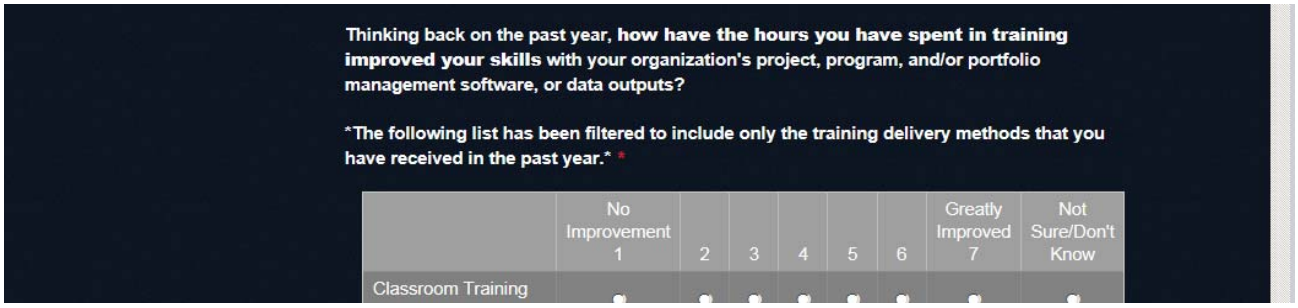
Table 9: Factors Examined in Research

No.	Factors Considered in Research	Variable Levels
		"Poor" to "Excellent"
15b	Management of multiple projects and programs; One Year Ago	8 Levels (7 Item Likert-Type) + Not Sure/Don't Know "Poor" to "Excellent"
15c	Management of multiple projects and programs; Impact of delivery method in the Past Year	8 Levels (7 Likert-Type) + Not Sure/Don't Know "No Improvement" to "Greatly Improved"
16a	Coordination of tasks and work; Current Self-Assessment of	8 Levels (7 Item Likert-Type) + Not Sure/Don't Know "Poor" to "Excellent"
16b	Coordination of tasks and work; One Year Ago	8 Levels (7 Item Likert-Type) + Not Sure/Don't Know "Poor" to "Excellent"
16c	Coordination of tasks and work; Impact of delivery method in the Past Year	7 Level (One-to-one with training types) (7 Likert-Type) + Not Sure/Don't Know "No Improvement" to "Greatly Improved"
17a	Decision making in individuals, project teams, and at the organization level; Current Self-Assessment of	8 Levels (7 Item Likert-Type) + Not Sure/Don't Know "Poor" to "Excellent"
17b	Decision making in individuals, project teams, and at the organization level; One Year Ago	8 Levels (7 Item Likert-Type) + Not Sure/Don't Know "Poor" to "Excellent"
17c	Decision making in individuals, project teams, and at the organization level; Impact of delivery method in the Past Year	8 Levels (7 Likert-Type) + Not Sure/Don't Know "No Improvement" to "Greatly Improved"
18	Before Training - Organizational Capabilities - Sum of all Impacts in the Past Year across the sum of all Impact in the Past Year for each Training Delivery Method	42 Theoretical Levels.
19	Before Training - Organizational Capabilities and Individual Proficiency - Sum of all Impacts in the Past Year across the sum of all Impact in the Past Year for each Training Delivery Method	42 Theoretical Levels.
20	After Training - Organizational Capabilities - Sum of all Impacts in the Past Year across the sum of all Impact in the Past Year for each Training Delivery Method	42 Theoretical Levels.
21	After Training - Organizational Capabilities and Individual Proficiency - Sum of all Impacts in the Past Year across the sum of all Impact in the Past Year for each Training Delivery Method	42 Theoretical Levels.

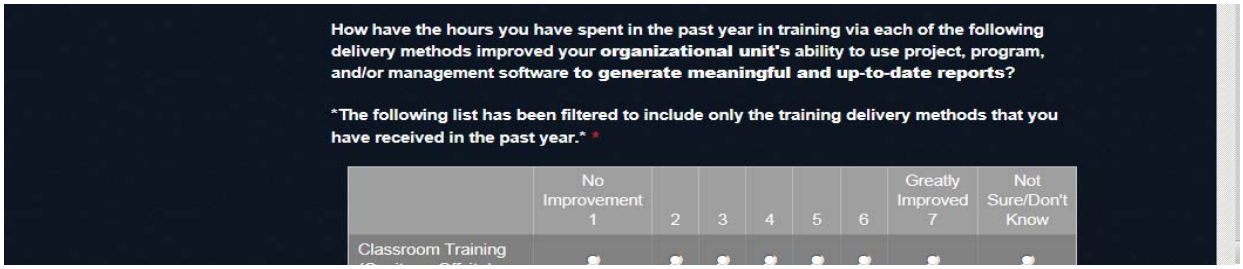
Table 9: Factors Examined in Research		
No.	**Factors Considered in Research**	**Variable Levels**
20	Total hours of training received per person. The sum of the number of hours for all training delivery methods.	Theoretically Infinite

The operationalization of the impact/effectiveness research construct is shown in the screenshots below. Training impact is measured on the basis of improvements in individual trainee skills with the toolset together with the following five organizational competencies: Reporting of project, program, and portfolio data; Management of multiple projects and programs; Coordination of tasks and work; Decision making in individuals, project teams, and at the organization level; and Speed and ease of access to project, program, and portfolio information.

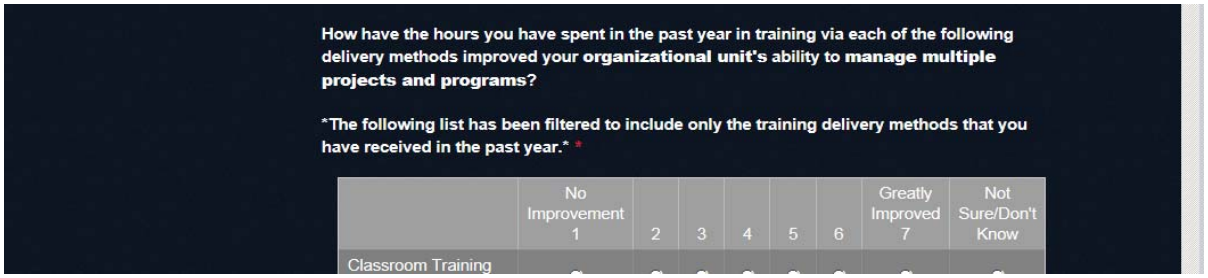
PMIS Training Impact Score – Component Score 1 of 6 – Answer Range: 0 to 7



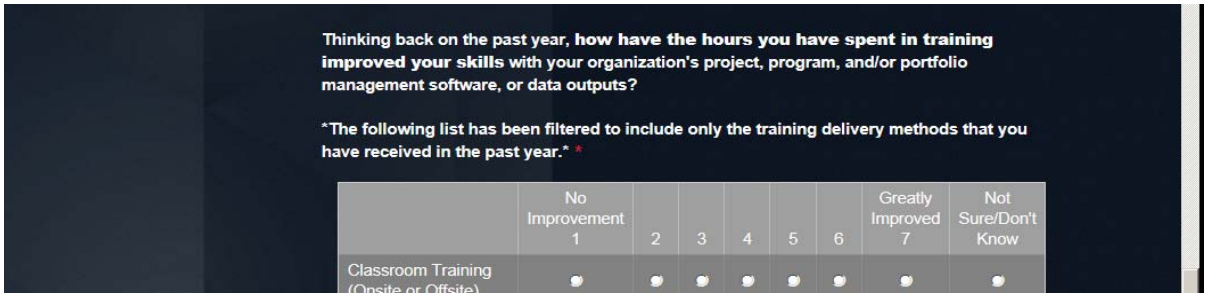
PMIS Training Impact Score – Component Score 2 of 6 – Answer Range: 0 to 7



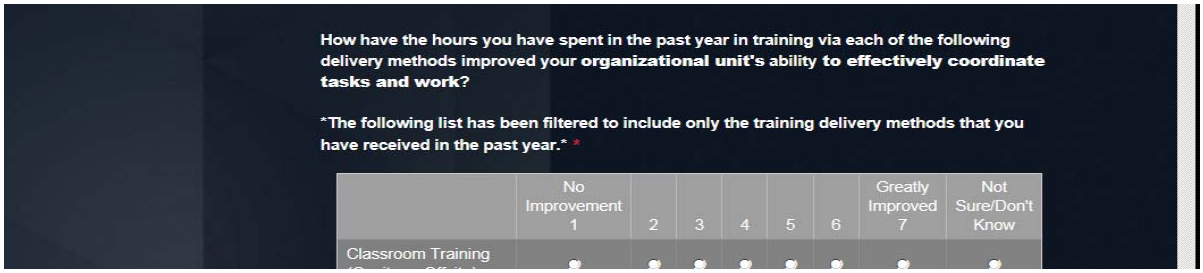
PMIS Training Impact Score – Component Score 3 of 6 – Answer Range: 0 to 7



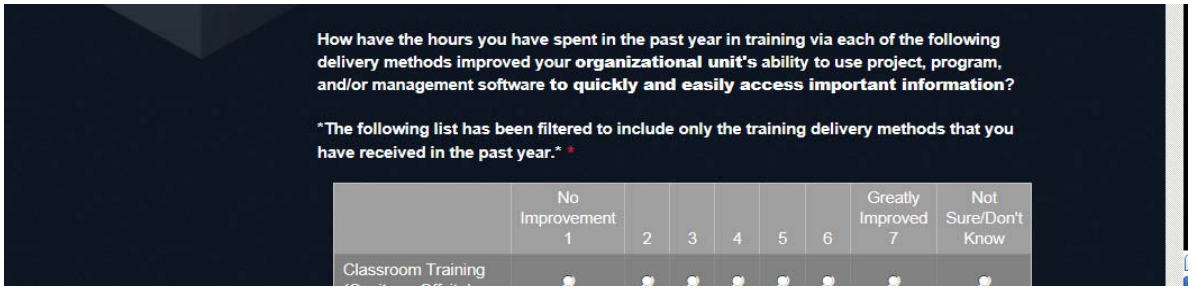
PMIS Training Impact Score – Component Score 4 of 6 – Answer Range: 0 to 7



PMIS Training Impact Score – Component Score 5 of 6 – Answer Range: 0 to 7



PMIS Training Impact Score – Component Score 6 of 6 – Answer Range: 0 to 7



The total impact score for each training delivery method is the sum of the respondent's scores on the above questions. The maximum impact score possible is 42.

5.3 Expert Input

To isolate the benefits that occur most often in practice as a result of PMIS training, an Expert Questionnaire was developed to send to experienced practitioners. The existing survey literature was referenced extensively. For each of the 172 benefits, the subject matter experts were asked to answer the following question:

"Based on your experience with project, program, portfolio management software and supporting systems, do you agree that PMIS training generally produces the following benefits?"

A seven-point Likert-type scale was developed to measure participant response. The questionnaire was created following extensive consultation of the current body of survey literature (DeVellis, 2012; Fowler, 1995; Groves, 2009; Krosnick & Presser, 2009; Tourangeau, Rips, & Rasinski, 2000). An answer of "7" would indicate strong agreement that PMIS training generally produces the benefit in question. Similarly, an answer of "1" would indicate strong disagreement. Finally, SMEs were instructed to use the "Not Sure" category if they were unfamiliar with a particular benefit or otherwise unable to assign a score of 1 to 7.

Expert experience statistics and calculations are shown in Table 10 below.

Table 10: Expert Questionnaire - Years of Professional Experience

Expert No.	Years Working in a Capacity Related to Project Management	Years Using Project Management Software	Std. Dev. And Var Calculation PM Work Xi-Xbar	PM Work $(Xi-Xbar)^2$	PM Software Xi-Xbar	PM Software $(Xi-Xbar)^2$
1	10	13	-6.7	44.4	-2.1	4.5
2	20	15	3.3	11.1	-0.1	0.0
3	28	28	11.3	128.4	12.9	166.1
4	12	12	-4.7	21.8	-3.1	9.7
5	13	13	-3.7	13.4	-2.1	4.5
6	3	3	-13.7	186.8	-12.1	146.7
7	33	25	16.3	266.8	9.9	97.8
8	6	7	-10.7	113.8	-8.1	65.8
9	25	20	8.3	69.4	4.9	23.9
Sum	150	136	0	856	0	518.9
Average	16.67	15.11				
Sample Std. Dev.	10.34	8.05				
n-1	8	8				
Sample Variance (S^2)				107.00		64.86
Sample Std. Dev. (S)				10.34		8.05

5.4 Pretesting of the Survey Instrument

The survey was pretested by a sample of twenty one members of a collaborative project management research consortium (The e-Construction Group; http://e-construction.pm.umd.edu) within the University of Maryland, College Park. The e-Construction Group conducts forward-looking research that seeks to engage cutting-edge technology as a tool to advance the dominant principles and practices of project-focused industries. Each pretester submitted a completed survey prior to providing feedback.

Feedback from pretest participants was very positive. Respondents who provided the approximate time that it took to complete the survey generally reported completion times of between 10 and 15 minutes. The survey was revised after the pretest and constructive feedback from the pre-testers was incorporated into the survey. All issues identified during pretesting were rigorously addressed and resolved.

The twenty one member sample of pretesters was composed of: Project Management faculty from University of Maryland, College Park; researchers and professors from other universities who specialize in PM; visiting scholars that specialize in PM; seasoned PM industry experts; graduate students pursuing advanced degrees in Project Management; and actively-engaged alumni of the graduate degree Project Management programs. Descriptions of revisions that were made to the survey as a result of the pretesting process are listed in the table below.

Table 11: Revisions made after Pretesting

Revision No.	Focus
1	Length and quantity of introductory material on first page reduced.
2	Removal of content pertaining to proposed survey incentives.
3	Questions 14 – 16 removed from survey. The combined expert review did not identify the contained benefit as one of the highest rated.
4	Questions 26 & 27 removed from survey. Both pertained solely to survey incentives. Question and page skip logic used throughout survey updated to direct participants to final "Thank you" page in survey.
5	Data output to be exported from most questions was updated to facilitate easy identification and statistical evaluation.
6	Removed section that mandated that all data collected would be destroyed on or before a stated date.
7	Moved section with researcher ID info from top of page to bottom.
8	Removed typo on page 2.
9	Added passage stating that survey has been pretested and approved by the UMD IRB Board.

Subject Selection

The targeted survey respondents were professionals who either (1) directly use project, program, and/or portfolio management software and supporting systems as part of their jobs; or who (2) use data generated by these systems to manage projects, programs, or portfolios. These individuals may, or may not have received training that has enhanced their use of the software in the past year.

The intended survey audience was selected because the research is intended to advance the body of knowledge in the area of project, program, and/or portfolio management software use by individuals and organizations. The professionals targeted as survey

respondents offer unique and unparalleled insight into the use of this software by practitioners in industry.

5.1 Data Collection

Industry research was conducted via web-based survey that was distributed by partnering with professional organizations, industry groups, and companies that are active in the PMIS community. Because of the web-based delivery method used to administer the survey, internationally-located respondents were able to participate in the survey.

5.2 Industry Partnership

As a way to stimulate greater industry engagement in research initiatives, an Industry Partnership initiative was initiated within the PM unit of the UMD Department of Civil and Environmental Engineering for this research. The intention of the initiative was to create a way to recognize and thank organizations for contributing to academic research efforts. In support of this objective, a central Industry Partners page was created directly beneath the main PM department website (http://pm.umd.edu). Each industry partner organization also has a unique page (accessible via link from the main Industry Partners page) that can be customized to provide more detailed information about the organization.

CHAPTER 6: RESULTS

6.1 Characteristics of the Sample

In total, 1,021 completed surveys representing seven professional organizations, industry groups, and companies that are active in the PMIS community were submitted and analyzed for this research. In alphabetical order, data from the following practitioner organizations has been included in this analysis:

- American Society for Professional Estimators (ASPE)
- Clarizen
- Edwards Project Solutions
- International Institute of Business Analysis (IIBA)
- Microsoft Project User Group (MPUG)
- National Precast Concrete Association (NPCA)
- Yahoo! Group cnbr-I; Cooperative Network for Building Researchers

Due to large differences in characteristics such as size, industry focus, and organizational mission, vastly differing numbers of completed responses from each participating organization were anticipated. Nevertheless, the emphasis of this research remains on exploring the true population and parameters of the community of PM software users to the greatest extent possible. Since the true population of PM software users is diverse, amorphous, and difficult to measure, an approach has been taken where the data is treated

as though it is from a single sample of the PM software-using community. Therefore, intensive between-groups analysis between practitioner organizations has not been undertaken.

Ordered from greatest to least, the number of completed surveys collected by each participating organization is identified below, along with the percentage of the 1,021 total completed surveys comprised by that number. Each participating organization has been identified by a unique letter between A and G.

Practitioner Organization

	Frequency	Percent
A	789	77.3
B	91	8.9
C	46	4.5
D	44	4.3
E	35	3.4
F	8	.8
G	8	.8
Total	1021	100.0

As illustrated in the following figure, 89.23% of respondents (911 out of 1,021) indicated that their organizations do indeed use PM software. Conversely, 10.77% of respondents (110 out of 1,021) answered that their organization did not use PM software.

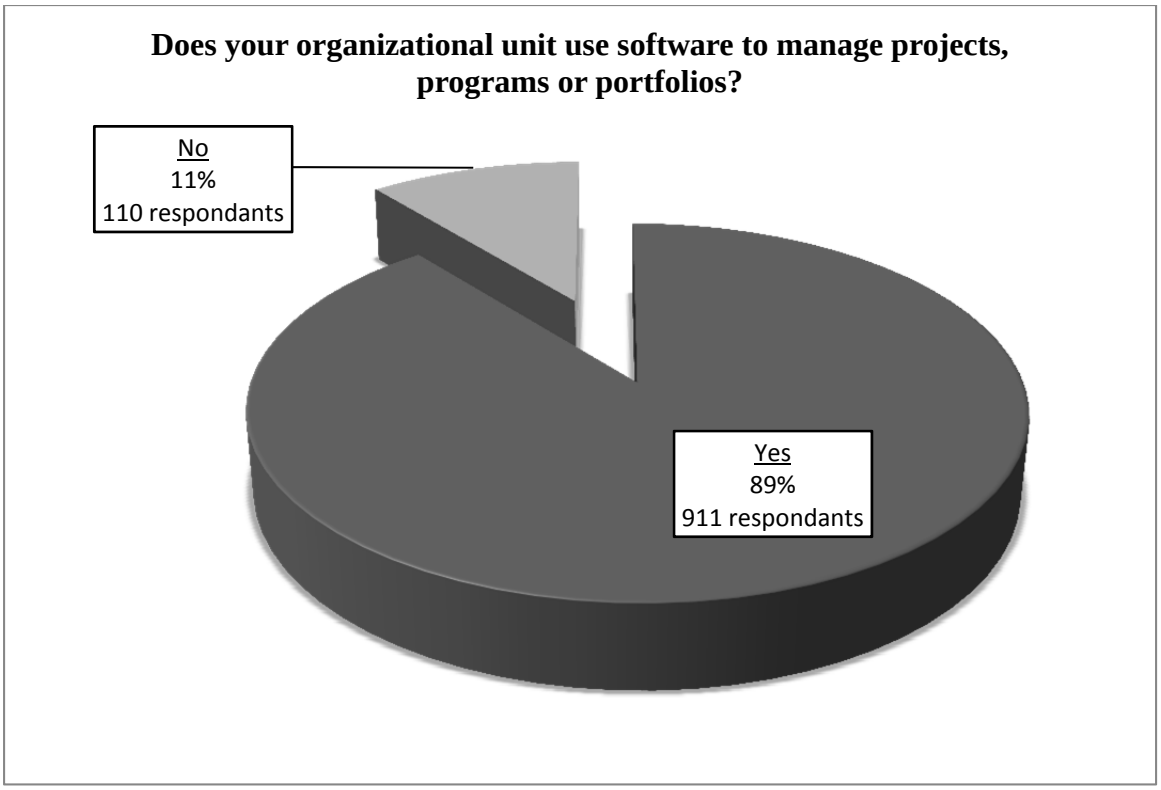


Figure 5: Pie Diagram of Sample PM Software Use

Within the respondents who indicated their organizations used PM software, only 65.42% (596 out of 911) reported receiving beneficial training within the past year via the examined delivery methods. Conversely, 10.77% (or 315 out of 911 respondents) reported no training. The overall average number of hours consumed via the examined training delivery methods was 24.50 hours (SD = 30.69). 1,348 individual data points corresponding to the 6 examined training delivery methods were reported by the 596 training recipients.

Examining each training delivery method, 16.16% of study participants (165 of 911) reported receiving training in the past 12 months via participation in professional organizations that conduct events on project management toolset usage. Similarly, 27.33% reported receiving training in the past 12 months via onsite or offsite classroom training, 33.69% reported receiving web-based training, 20.37% reported participating in "Lunch and Learn" Style Training Sessions, 21.55% reported coaching/mentoring, and 12.93% reported conference participation (344, 208, 220, 132 respectively).

Among respondents who reported receiving training via professional organizations, the mean number of hours of professional organization training consumed in the past 12 months was 14.28 hours. Those who reported beneficial classroom training spent an average of 19.64 hours in classroom training in the past year. Consumers of web-based training reported an average of 13.92 hours of web-based training. Those who participated in "Lunch and Learn" style training, coaching/mentoring, and conference training, consumed an average of 15.91, 15.35, and 14.67 of each delivery method respectively.

To further explore the training delivery methods modern organizations are using to deliver PMIS training, the number of training hours received per delivery method has been analyzed using a one-way mixed effects ANOVA. Delivery method has been treated as a random independent variable and hours as a fixed independent variable. Respondents scores were confirmed to be independent within and across treatment groups. Statistically

significant differences were found in the use of the examined training delivery methods to deliver project, program, and portfolio management toolset training ($F_{5,1342} = 2.22$, p=.001).

6.2 Current Consumption of PMIS Training by Delivery Method

Examining each training delivery method, 16.16% of study participants (165 of 911) reported receiving training in the past 12 months via participation in professional organizations that conduct events on project management toolset usage. Similarly, 27.33% reported receiving training in the past 12 months via onsite or offsite classroom training, 33.69% reported receiving web-based training, 20.37% reported participating in "Lunch and Learn" Style Training Sessions, 21.55% reported coaching/mentoring, and 12.93% reported conference participation (344, 208, 220, 132 respectively).

Among respondents who reported receiving training via professional organizations, the mean number of hours of professional organization training consumed in the past 12 months was 14.28 hours. Those who reported beneficial classroom training spent an average of 19.64 hours in classroom training in the past year. Consumers of web-based training reported an average of 13.92 hours of web-based training. Those who participated in "Lunch and Learn" style training, coaching/mentoring, and conference training, consumed an average of 15.91, 15.35, and 14.67 of each delivery method respectively.

The pie chart below shows the total number of instances of training reported via each examined delivery method and the percentage of all reported training sessions comprised by each delivery method.

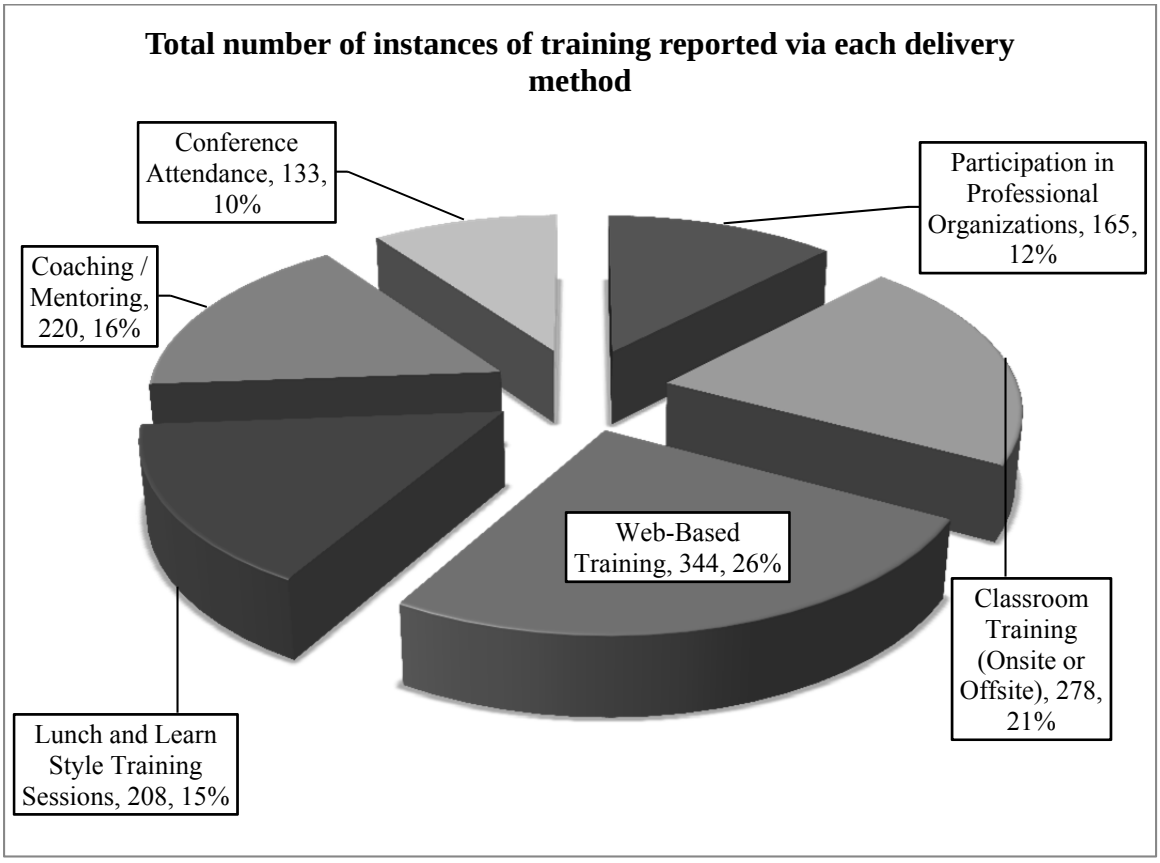


Figure 6: Training Delivery - Pie Chart

To quantitatively explore which training delivery methods modern organizations are using to deliver PMIS training to their employees, the mean number of training hours

received per delivery method has been analyzed using a one-way mixed effects ANOVA analysis, where delivery method is treated as a random independent variable and hours is treated as a fixed independent variable.

Calculation Inputs/Outputs

$\alpha = 0.05$,
J = 6, Six treatment groups
N = 1348, there are 1348 different observations of training (corresponding to the total impact reported per training delivery method per respondent) included in the study.
J-1 = 6-1 = 5
N-J = 1348 – 6 = 1342
df = (5, 1342)
F(0.95, 5, 1342) = 2.221
Observed F Value: 12.200
p=.001

Table 12: Table of Means –Hours Reported per Delivery Method

	Delivery Method	Mean	Std. Deviation	N
1	Participation in Professional Organizations	14.28	17.498	165
2	Classroom Training (Onsite or Offsite)	19.64	18.911	279
3	Web-Based Training	13.92	17.362	344
4	Lunch and Learn Style Training Sessions	7.84	10.086	208
5	Coaching/Mentoring	15.91	18.560	220
6	Conference Attendance	15.35	14.884	132
	Total	14.67	17.141	1348

The observed value of the F statistic was 12.200, which is larger than the 2.221 critical value of the F statistic, therefore, the null hypothesis is rejected. The difference in the value of F tells us that the variation between groups is much greater than the variation within groups. The observed Sig. value is .001. This is less than α, and thus these results appear to be significant and are not likely to have resulted from chance alone. Therefore, the results suggest that there is a statistically significant difference in the utilization of the examined training delivery methods as they are being used in practice.

6.3 Effectiveness of Training Delivery Methods

Although research generally shows that delivery methods are equally effective when learners are evaluated in controlled environments, the intention of this question is determine which training delivery methods are creating greater increases in individual proficiency levels with the toolsets in practice. No data available that evaluates the effectiveness of various training techniques in increasing individual proficiency with the toolset, and organizational value provided by project, program, and portfolio management software and supporting systems.

Out of a maximum possible score of 42, classroom training had the highest reported impact (26.36), followed by coaching/mentoring (25.42), conference (24.41), web-based training (23.33), professional organizations (22.98), and “lunch and learn” style training (21.4231). Across all examined delivery methods, the average impact score was 24.06 out of a maximum possible score of 42.

A multi-way mixed effects ANOVA model was employed with training delivery method treated as a random independent variable, and self-assessed individual and organizational capabilities as a fixed dependent variable. The emphasis in this analysis is maximizing the total change in skill levels and organizational competencies. The following analysis is performed using a multi-way mixed effects ANOVA model by treating training delivery method as a random independent variable, and self-assessed individual and organizational capabilities as a fixed dependent variable.

Analysis of participant data indicates that delivery method used to administer project management software training makes statistically-significant difference in perceived training impact ($F_{5,1342} = 2.22$, $p<.001$).

The independent variable is the training delivery method. The independent variable is nominal. The dependent variable is the total additive score of each survey respondent across the individual and organizational disciplines. The dependent variable is ratio scale, with a maximum possible value of 42. The research hypothesis is as follows: The delivery method used to administer project management software training delivery method makes a difference in post-training impact.

Table 13: Table of Means –Impact per Delivery Method

	Delivery Method	Mean	Std. Deviation	N
1	Participation in Professional Organizations	22.98	10.55	165
2	Classroom Training (Onsite or Offsite)	26.36	10.28	279
3	Web-Based Training	23.33	10.16	344
4	Lunch and Learn Style Training Sessions	21.42	9.79	208
5	Coaching/Mentoring	25.42	10.38	220
6	Conference Attendance	24.41	9.95	132
	Total	24.06	10.31	1348

Calculation Inputs/Outputs
$\alpha = 0.05$,
J = 6, Six treatment groups
N = 1348, there are 1348 different observations of training (corresponding to the total impact reported per training delivery method per respondent) included in the study.

J-1 = 6-1 = 5
N-J = 1348 – 6 = 1342
df = (5, 1342)
F(0.95, 5, 1342) = 2.221
Observed F Value: 7.149
p=.000

The observed value of the F statistic was 7.149, which is larger than the 2.221 critical value of F, therefore, the null hypothesis is rejected. The difference in the value of F tells us that the variation between groups is much greater than the variation within groups. The

observed Sig. value is .000. This is less than α, and thus these results appear to be significant and are not likely to have resulted from chance alone. Therefore, the results suggest that there is a statistically significant difference in the effectiveness of the examined training delivery methods as they are being implemented in practice.

6.4 Efficiency of Training Delivery Methods

Of the examined training delivery methods, "Lunch and learn" style training created the largest impact per training hour, with the highest efficiency score (6.529). In descending order, the mean efficiency scores for each training delivery method are coaching/mentoring (5.44), web-based training (5.22), conference (4.61), classroom training (4.21), and professional organizations (3.86).

The following analysis is performed using a multi-way mixed effects ANOVA model by treating training delivery method as a random independent variable, and self-assessed individual and organizational capabilities as a fixed independent variable. The independent variable is the training delivery method. The independent variable is nominal. To create a measure of efficiency, the dependent variable for this test is the total additive impact score of each survey respondent across the individual and organizational disciplines, divided by the number of hours spent in each training session. The dependent variable is a ratio-level variable. The research hypothesis is as follows: The delivery method used to administer project management software training delivery method makes

a difference in the time-efficiency of training, or the quotient of reported impact divided by reported time spent in each delivery method.

Table 14: Table of Means –Impact/Hour per Delivery Method

	Delivery Method	Mean	Std. Deviation	N
1	Participation in Professional Organizations	3.86	4.23	165
2	Classroom Training (Onsite or Offsite)	4.21	6.59	279
3	Web-Based Training	5.22	6.83	344
4	Lunch and Learn Style Training Sessions	6.53	7.21	208
5	Coaching/Mentoring	5.44	7.93	220
6	Conference Attendance	4.61	6.88	132
	Total	5.02	6.82	1348

Calculation Inputs/Outputs

From Lomax (2001):

Critical Value of $F = {}_{1-\alpha}F_{(J-1,N-J)}$

$\alpha = 0.05$,

$J = 6$, Six treatment groups

$N = 1348$, there are 1348 different observations of training (corresponding to the total impact reported per training delivery method per respondent) included in the study.

$J-1 = 6-1 = 5$

$N-J = 1348 – 6 = 1342$

df = (5, 1342)

$F(0.95, 5, 1342) = 2.221$

Observed F Value: 4.137

$p=.001$

The observed value of the F statistic was 4.885, which is larger than the 2.221 critical value of F, therefore, the null hypothesis is rejected. The difference in the value of F tells us that the variation between groups is much greater than the variation within groups. The observed Sig. value is .001. This is less than α (.05), and thus these results appear to be significant and are not likely to have resulted from chance alone. Therefore, the results suggest that there is a statistically significant difference in the time-efficiency of the examined training delivery methods as they are being implemented in practice.

Analysis of the completed surveys suggests that the delivery method used to administer project management software training makes a difference in the time-efficiency of training initiatives ($F_{5,1342} = 2.22$, $p<.001$). Therefore, the results suggest that there is a statistically significant difference in the time-efficiency of the examined training delivery methods as they are being implemented in practice.

6.5 Relationships Between Training and Other Individual and Organizational Factors

The current literature suggests that a variety of individual and organizational characteristics may influence PMIS training needs and outcomes. This research explores number of years of experience in project management, number of years of experience using pm software, number of projects managed simultaneously, typical project duration, typical project size, project complexity, primary role, industry focus, length of time org.

unit used pm software to manage projects, training delivery method, number of hours completed, and self-assessed individual proficiency level.

As a means to identify potential relationships between individual/organizational characteristics and training practices, each individual/organizational variable was tested against the other variables using a one way ANOVA analysis. Using multiple one way fixed-effects ANOVA analysis procedures to compare variables can raise the family-wise error rate above the .05 threshold used in each analysis. A Bonferroni correction was used to control the overall Type I error rate that results from the utilization of multiple significance tests. This correction procedure was selected because of its tendency to be too conservative when many tests are performed (Cheverud, 2001; Pocock, Geller, & Tsiatis, 1987).

Computationally, the Bonferroni correction results in adjusted significance thresholds. The significance threshold obtained through Bonferroni correction are reduced since each analysis in this section consists of seven comparison procedures. The significance thresholds in this section are $\alpha/N = .05/7 = .007143$. A Pearson product-moment correlation analysis has also been utilized as a means to gain perspective into the strength and directionality of potential relationships.

When treated as an independent variable, primary role was found to impact complexity ($F=3.922$, $p=.000006$) and typical project size ($F=3.427$, $p=.000059$) where in both cases the critical value of F is $F_{(12, 1,008)} =1.762$. Typical project complexity, when analyzed as

an independent variable suggests a possible relationship with typical project duration (F=11.318, p=.000000), typical project size (F=11.841, p=.000000), and the organization using PM software to manage projects (F=4.683, p=.000104). In all three cases, the critical value of the F statistic is $F_{(6, 1,014)} = 2.108$. Analysis of industry focus and typical number of projects as independent variables did not produce evidence of significant meaningful relationships. Analysis of typical project duration as an independent variable suggests relationships with typical project complexity (F=8.742, p=.000000), typical project size (F=40.645, p=.000000), and the length of time that the organization has used PM software to manage projects (F=4.387, p=.000588). In all three cases, the critical value of the F statistic is $F_{(5, 1,015)} = 2.223$.

When typical project size was isolated and analyzed as an independent variable, potential relationships were observed with complexity (F=12.187, p=.000000), typical project duration (F=58.118, p=.000000), and the use of PM software to manage projects (F=3.709, p=.002482). Analyzing the aggregated survey data with the independent variable designated to be whether or not the organization uses specialized software and/or systems to manage projects suggests potential relationships with project complexity (F=19.947, p=.000000), and typical size of projects (F=11.474, p=.000733). The critical value of the F statistic is $F_{(5, 1,015)} = 2.223$.

Finally, the length of time that the organization has used PM tools to manage projects was examined as an independent variable. The results of this analysis suggest a

relationship with primary role (F=4.864, p=.000211), complexity (F=5.790, p=.000028), industry (F=4.616, p=.000360), project size (F=4.864, p=.000211), and as anticipated, the use of PM tools to manage projects (F=82.324, p=.000000). The critical value of the F statistic for this portion of the analysis is $F_{(5, 1,015)} = 2.223$. The following table contains the results of group means equality testing.

Table 15: ANOVA Tests of Equality of Group Means

*Bonferroni-corrected significance threshold = .007143

Independent Variable	Dependent Variable	Observed F Value	Significance	Critical F Value	df
Primary Role	Primary Role	-	-	-	-
	Complexity	3.922	.000006	1.762	(12, 1,008)
	Industry	2.649	.001681	1.762	(12, 1,008)
	Number Of Projects	.959	.487101	1.762	(12, 1,008)
	Project Duration	2.550	.002521	1.762	(12, 1,008)
	Size	3.427	.000059	1.762	(12, 1,008)
	Org Use PM Software?	2.007	.020900	1.762	(12, 1,008)
	Duration PM Software In Use	1.368	.175344	1.762	(12, 1,008)
Complexity	Primary Role	.515	.797048	2.108	(6, 1,014)
	Complexity	-	-	-	-
	Industry	.468	.832430	2.108	(6, 1,014)
	Number Of Projects	.835	.543121	2.108	(6, 1,014)
	Project Duration	11.318	.000000	2.108	(6, 1,014)
	Size	11.841	.000000	2.108	(6, 1,014)
	Org Use PM Software?	4.683	.000104	2.108	(6, 1,014)
	Duration PM Software In Use	1.259	.273751	2.108	(6, 1,014)
Industry	Primary Role	4.453	.000000	1.702	(14, 1,006)
	Complexity	.782	.689579	1.702	(14, 1,006)
	Industry	-	-	-	-
	Number Of Projects	1.089	.363400	1.702	(14, 1,006)
	Project Duration	1.734	.044149	1.702	(14, 1,006)
	Size	2.020	.014005	1.702	(14, 1,006)
	Org Use PM Software?	.685	.791162	1.702	(14, 1,006)
	Duration PM Software In	1.706	.049230	1.702	(14, 1,006)

Table 15: ANOVA Tests of Equality of Group Means

*Bonferroni-corrected significance threshold = .007143

Independent Variable	Dependent Variable	Observed F Value	Significance	Critical F Value	df
	Use				
Number of Projects	Primary Role	.188	.967358	2.223	(5, 1,013)
	Complexity	.568	.724222	2.223	(5, 1,013)
	Industry	1.180	.316681	2.223	(5, 1,013)
	Number Of Projects	-	-	-	-
	Project Duration	2.270	.045698	2.223	(5, 1,013)
	Size	.285	.921562	2.223	(5, 1,013)
	Org Use PM Software?	.709	.616370	2.223	(5, 1,013)
	Duration PM Software In Use	1.547	.172407	2.223	(5, 1,013)
Project Duration	Primary Role	1.917	.088900	2.223	(5, 1,015)
	Complexity	8.742	.000000	2.223	(5, 1,015)
	Industry	1.361	.236619	2.223	(5, 1,015)
	Number Of Projects	1.114	.351025	2.223	(5, 1,015)
	Project Duration	-	-	-	-
	Size	40.645	.000000	2.223	(5, 1,015)
	Org Use PM Software?	.484	.788492	2.223	(5, 1,015)
	Duration PM Software In Use	4.387	.000588	2.223	(5, 1,015)
Project Size	Primary Role	1.383	.228146	2.223	(5, 1,015)
	Complexity	12.187	.000000	2.223	(5, 1,015)
	Industry	1.665	.140391	2.223	(5, 1,015)
	Number Of Projects	.937	.455791	2.223	(5, 1,015)
	Project Duration	58.118	.000000	2.223	(5, 1,015)
	Size	-	-	-	-
	Org Use PM Software?	3.709	.002482	2.223	(5, 1,015)
	Duration PM Software In Use	2.633	.022448	2.223	(5, 1,015)
Org Use PM Software?	Primary Role	1.284	.257387	2.223	(5, 1,015)
	Complexity	19.947	.000009	2.223	(5, 1,015)
	Industry	1.569	.210701	2.223	(5, 1,015)
	Number Of Projects	.156	.692876	2.223	(5, 1,015)
	Project Duration	1.272	.259582	2.223	(5, 1,015)
	Size	11.474	.000733	2.223	(5, 1,015)
	Org Use PM Software?	-	-	-	-
	Duration PM Software In Use	.080	.776769	2.223	(5, 1,015)
Duration PM Software In Use	Primary Role	4.865	.000210	2.223	(5, 1,015)

Table 15: ANOVA Tests of Equality of Group Means

*Bonferroni-corrected significance threshold = .007143

Independent Variable	Dependent Variable	Observed F Value	Significance	Critical F Value	df
	Complexity	5.790	.000028	2.223	(5, 1,015)
	Industry	4.616	.000360	2.223	(5, 1,015)
	Number Of Projects	1.321	.252729	2.223	(5, 1,015)
	Project Duration	3.420	.004536	2.223	(5, 1,015)
	Size	4.864	.000211	2.223	(5, 1,015)
	Org Use PM Software?	82.324	.000000	2.223	(5, 1,015)
	Duration PM Software In Use	-	-	-	-

The following table contains the results of a Pearson product-moment bivariate correlation analysis. The results suggest that hours of training consumed and impact of training are significantly related and positively correlated. The data also suggests a strong positive correlation between years of professional experience related to PM and years of PM software use.

Table 16: Pearson Product-Moment Coefficients

Pearson Correlations		Impact	Hours	Efficiency	Delivery Method	Years Experience Related to PM	Years PM Software Experience
Impact	Pearson Correlation	1	.266**	.121**	-.004	-.001	.005
	Sig. (2-tailed)		.000	.000	.870	.974	.857
Hours	Pearson Correlation	.266**	1	-.443**	-.053	.028	.044
	Sig. (2-tailed)	.000		.000	.051	.308	.109
Efficiency	Pearson Correlation	.121**	-.443**	1	.057*	-.045	-.014
	Sig. (2-tailed)	.000	.000		.037	.099	.608
Delivery Method	Pearson Correlation	-.004	-.053	.057*	1	-.043	-.025
	Sig. (2-tailed)	.870	.051	.037		.113	.360
Years PM Experience	Pearson Correlation	-.001	.028	-.045	-.043	1	.691**
	Sig. (2-tailed)	.974	.308	.099	.113		.000
Years Software Experience	Pearson Correlation	.005	.044	-.014	-.025	.691**	1
	Sig. (2-tailed)	.857	.109	.608	.360	.000	

6.6 The Appropriate Amount to Pay for PMIS Training

Organizations currently have no way of objectively evaluating whether the amount they are paying for PMIS training is appropriate. Forrester Research employs an estimating methodology, "Total Economic Impact™" (TEI) Methodology that be leveraged to address this question. The idea behind the TEI is an economic model that is generated using realistic assumptions for human resource requirements, cash flow, efficiency, organizational adoption timelines, hardware and software investment required, etc. (Symons, 2009).

Regression analysis can be used to develop formulas to estimate the number of hours of training required to raise the self-assessed PMIS skill levels of individuals, or the organizational PM competencies of the organization. Analysis was performed separately for each training delivery method: classroom training, coaching/mentoring, conference, web-based training, professional organizations, and "lunch and learn" style training sessions.

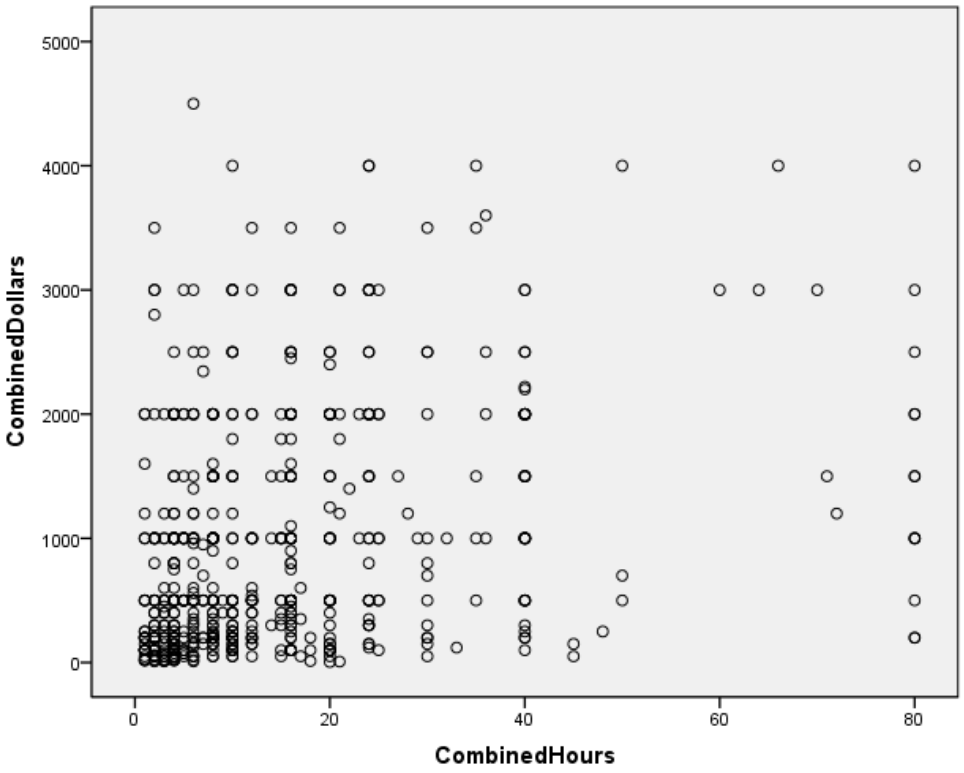


Figure 7: Scatterplot of Hours and Dollars across all delivery methods

To capture estimated costs for training delivered via each of the examined delivery methods, industry survey participants were prompted the following question:

"If you were to estimate, how much was spent in the past year on training sessions you received that improved your use of project, program, or portfolio management software via each of the following delivery methods?

Exclude the cost of your wages, but be sure to include travel and meals."

Table 17: Regression Statistics

	Delivery Method	Intercept	Dollarized Regression Coefficient	n	R Square
1	Participation in Professional Organizations	440.80	15.83	102	.066
2	Classroom Training (Onsite or Offsite)	877.40	24.80	161	.142
3	Web-Based Training	685.48	19.36	152	.076
4	Lunch and Learn Style Training Sessions	277.58	34.31	81	.169
5	Coaching/Mentoring	735.76	17.88	67	.147
6	Conference Attendance	1015.64	25.78	59	.059
7	Combined Model	637.22	19.80	622	.107

Using the intercept and slope coefficient from the regression analysis, the following general-form equation is created for estimating total cost based on total hours of training required. The regression formula is:

Y_i = [($)Intercept] + [($)Dollarized Regression Coefficient] x [Total Hours of Training]

This general equation can be used to derive formulae to estimate the cost of training delivered via each of the examined delivery methods:

$$\mathbf{Y_{ProfOrgs} = \$440.80 + \$15.83 \times [Total\ Hours\ of\ Training]}$$

$$\mathbf{Y_{Classroom} = \$877.40 + \$24.80 \times [Total\ Hours\ of\ Training]}$$

$$\mathbf{Y_{Web} = \$685.48 + \$19.36 \times [Total\ Hours\ of\ Training]}$$

$$\mathbf{Y_{Lunch} = \$277.58 + \$34.31 \times [Total\ Hours\ of\ Training]}$$

$$\mathbf{Y_{Coaching} = \$735.76 + \$17.88 \times [Total\ Hours\ of\ Training]}$$

$$\mathbf{Y_{Conference} = \$1015.64 + \$25.78 \times [Total\ Hours\ of\ Training]}$$

These formulae are plotted in the following figure. Regression modeling can be used estimate the cost of PMIS training as a function of training delivery method and person-hours of training to be received.

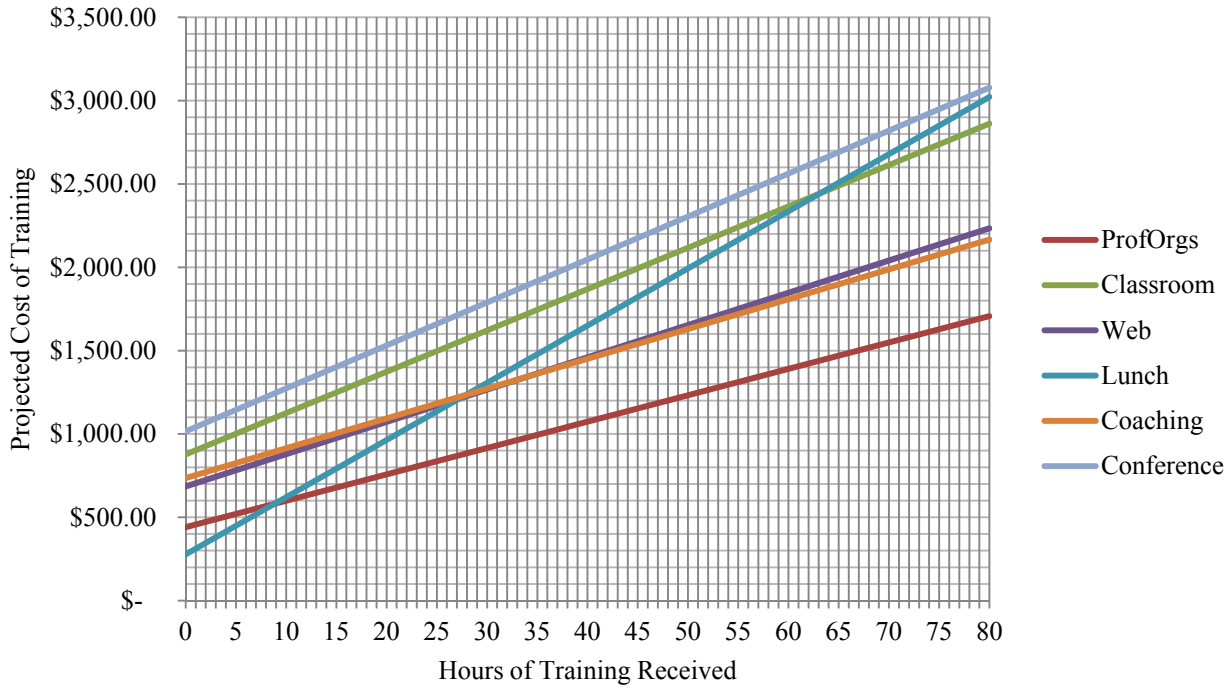


Figure 8: Training Cost Regression Model

For a person anticipating 20 hours of classroom training in the coming year, the cost estimated by the regression formula is:

$Y_{(Classroom,\ 20)} = \$877.40 + \$24.80 \times [20]$

$Y_{(Classroom,\ 20)} = \$877.40 + \$496$

$Y_{(Classroom,\ 20)} = \$1,373.40$

Or for a person anticipating 40 hours of coaching in the coming year, the cost estimated by the regression formula is:

$Y_{(Coaching,\ 40)} = \$735.76 + \$17.88 \times [40]$

$Y_{(Coaching,\ 40)} = \$735.76 + \$715.20$

$Y_{(Coaching,\ 40)} = \$1{,}450.96$

CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

7.1 Research Summary

To explore which training delivery methods modern organizations are using to deliver PMIS training to their employees, the mean number of training hours received per delivery method was analyzed using a one-way mixed effects ANOVA. Training delivery method was treated as a random independent variable and hours of training was treated as a fixed independent variable. The null hypothesis was rejected, and the statistical results suggest a mathematically significant difference in the time-efficiency of the examined training delivery methods as they are being implemented in practice.

Although research generally shows that delivery methods are equally effective when learners are evaluated in controlled environments, the intention of this question was to investigate which training delivery methods are creating greater increases with the toolsets in practice. Survey participants were asked to respond to a series of questions that rate how the training that they have been given in the past year has impacted their proficiency level with the PMIS tools they use and the value to their organization. The emphasis in this research question was maximizing the total magnitude of change in skill levels and organizational competencies. A multi-way mixed effects ANOVA analysis was performed, with training delivery method treated as a random independent variable, and self-assessed individual and organizational capabilities as a fixed dependent variable. The null hypothesis was again rejected, suggesting a statistically significant difference in the effectiveness of each training delivery method.

PMIS training efficiency data was generated by performing an impact-per-unit-time analysis of the impact of each training delivery method on individual user proficiency and organizational value, calculated per hour consumed of each training delivery method. Training delivery methods with higher calculated efficiency metrics demonstrate higher values of the ratio of total change in skill levels and organizational competencies to the number of hours received per delivery method. A multi-way mixed effects ANOVA analysis was performed, treating training delivery method as a random independent variable, and self-assessed individual and organizational capabilities as a fixed independent variable. A regression approach was utilized in developing a model for estimating PMIS training costs.

7.2 Conclusions

The outcomes of this research expand the domain of PM research into previously undocumented and poorly understood areas of training success factors in training related to PMIS deployment, operation, or enhancement. Research results also have immediate implications in advancing practices related to training, promoting enhanced realization of benefits to stakeholders, and promoting success and improved outcomes in PMIS deployment projects. The outcomes of this research will result in improved conceptual understanding of PMIS training. The potential for improved training to create positive impact practitioners and improved outcomes to the body of knowledge are significant. Practitioners, researchers, organizations, PMO personnel, executive management,

training personnel, and consultants all may benefit from this research. Owners, end-users of project deliverables, and many other stakeholders with an interest in successful PMIS use are positioned to benefit as well. Individuals, teams, and entire organizations may benefit (Kaiser & Ahlemann, 2010).

The findings of this research create new visibility into PMIS usage, training delivery, and benefits realization across a diverse range of organizations that span a broad swath of industries and project types. Factors and patterns that show positive relationships with successful PMIS training outcomes can be leveraged by practitioners to improve PMIS training or isolated for future investigation by researchers. Organizations may be interested in the methodology developed for this research to generate additional uniquely available data that depicts training practices across the industry.

Team members and PMO staff stand to benefit from PMIS training that enhances collaboration and teamwork. By enabling trainees to perform their job responsibilities better and promoting individual success, improved training offers substantial benefits to project contributors. Similarly, improved training may teach individuals the skills necessary for a higher-level position, thereby promoting career advancement in individuals.

Consistent with past research by Thomas and Mullaly (2008), the findings of this research suggest that learners that have received more hours of training show higher levels of self-reported proficiency increases and organizational value provided. The data

generated from this research initiative creates a groundwork for expanded research into training characteristics and PMIS success. Training characteristics that appear to have significant positive relationships with successful outcomes could be subjected to further analysis through experimental research. On-going scientific evaluation would result in continuous refinements to theory and practice of training within the PMIS industry, lead to a deeper, more nuanced understanding of factors that contribute to fruitful realization of positive outcomes from PMIS training, promote a greater understanding of successful PMIS implementation, and facilitate improved project management practices.

7.3 Validation of Assumptions, Appropriateness of Analysis Methodology, and Interpretation of Results

By definition, since the research approach did not allow for respondents to be randomly assigned to treatment groups (receipt of delivery method), the investigational methodologies employed in this research deviate from true scientific experimental design. Because each training type was data was treated as a separate data point in the statistical analyses, respondents who reported more than one type of training have multiple data points associated with them. This has negatively implications for statistical independence between variables. However, the negative impacts on assumptions of independence were determined to be within acceptable tolerance for the statistical analysis techniques selected for this research. The external validity or the extent to which

the results of the study may be correctly generalized to the population of interest may be less questionable since the large sample may serve to balance out variations in responses.

It is worthy to note that the Likert-type response scales used to evaluate training impact technically render data at the ordinal level of measurement, due to the fact that response options did not define explicit units or intervals of measurement. Mathematically, arithmetic operations, including sum and mean, that have meaning at higher interval or ratio levels of measurement may not necessarily be meaningful when analyzing data at the ordinal level. This research utilizes the Rasch model developed by Rasch (1966) to justify analysis of the collected survey data at interval level. Mathematical analysis has shown the Rasch model to be statistically robust (Wright, 1977). The Likert-type measurement constructs used in the survey instrument were designed with consistent and equal intervals of measurement (i.e: sequentially ordered whole intervals, sequenced from 0 to 7) across questions that represent data points that are aggregated in the analysis. The uniform threshold discriminations used in the response scales allow the Rasch model to be utilized. It can be shown that scoring reduces to successive categories and sequential integers (Andrich, 1978).

7.4 Contributions to the Body of Knowledge

To date, there has been no scholarly research that focuses exclusively on PMIS training. This research is vitally important in that at present time, organizations have no way to

objectively evaluate the best training options for their organization or to objectively evaluate the fair value for training based on the unique PMIS goals of the organization, the current proficiency levels of the employees, the current options for training delivery methods. Practitioners also have no way of knowing how hours spent in training translate to self-reported improved proficiency with the toolset and organizational value created.

The results of this research will be of particular interest to researchers, consultants, and those considering initiating or continuing investment in PMIS. This research provides a framework that can be leveraged to evaluate the delivery of value from PMIS implementation. The research also investigates the relative effectiveness and efficiency of various training delivery methods at increasing key PMIS outcomes, the effects of individual and organizational differences on PMIS training outcomes, and the appropriate amount to pay for PMIS training. The results of this research, as well as the methodologies employed to generate those results may be incorporated into requirements gathering, planning PMIS training programs, and generating budgets for PMIS training.

7.5 Recommendations for Future Research

Simply utilizing a PMIS does not guarantee project success. If poor project management processes exist prior to the implementation of a PMIS, the toolset will simply automate the defective processes (Bednarz & Dubie, 2006). However, there is a distinct need for

research on the best ways to use training to increase the value delivered by project and program management software. Kastel (2009) notes that many organizations are embracing project management training and education. HP and the US Army have embraced a philosophy where everything is treated like a project, and problems are approached with a structured project management approach.

It has been found that organizations that stop investing in project management begin to lose maturity almost immediately (J. Thomas & Mullaly, 2007). The issue of the availability versus consumption of training hours is also an interesting area to be explored. One question of importance is what project conditions justify the use of advanced project management information systems and when a simpler tool like Microsoft Excel would be sufficient. Managing simple or short duration projects in project management information systems may be undesirable because of the increased effort and time required to manage the projects using the PMIS. Project cost, complexity, risk, and duration are all factors that organizations use when determining whether to manage an initiative within a PMIS. Recent literature suggests that project management information systems can have a pejorative effect on project team agility (Bednarz & Dubie, 2006).

APPENDICES

Twelve Areas of Impact – Summary Overview

Table 18: Twelve Areas of Beneficial Training Impact

No.	General Area of Improvement
1	Accountability
2	Attitude
3	Communication & Collaboration
4	Cost/Time
5	Effectiveness and Efficiency
6	Knowledge Management
7	Market Presence
8	Strategic and Enterprise
9	Performance
10	Resource Management
11	Risk
12	Stakeholder Management

Twelve Areas of Impact – Composition

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
1	Accountability	Improved Accountability	
2	Accountability	Improved Ability to Audit Data and Comply with Regulations	
3	Accountability	Improved Delegation of Tasks and Responsibilities	
4	Accountability	Improved Clarity of Roles, Responsibilities, and Structures	
5	Attitude	Decreased Absenteeism	
6	Attitude	Improved Acceptance of Technology	The literature shows that receiving training can improve end user acceptance of computer-related technologies.
7	Attitude	Improved Training Participant Attitudes	
8	Attitude	Improved Commitment to Objectives	Improved commitment to team or organizational objectives
9	Attitude	Improved Cross Cultural Adjustment	
10	Attitude	Improved Support for the Organization's Project, Program, and Portfolio Management Practices	
11	Attitude	Faster Adoption of Technology	
12	Attitude	Improved Morale	
13	Attitude	Improved Motivation	
14	Attitude	Reduced Perceived Anxiety within Training Participants	Perceived anxiety refers to feelings of nervousness, apprehension, or uneasiness in using a computer system.
15	Attitude	Improved Self-Actualization	Self-Actualization can be described as satisfaction derived from realizing an individual's full potential.
16	Attitude	Improved Self-Efficacy	Self-Efficacy refers to a belief within an individual that he or she can successfully perform a specific task. Self-Efficacy is shown in the literature to be strongly associated with job performance.
17	Communication & Collaboration	Improved Collaboration between Individuals and Teams	

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
18	Communication & Collaboration	Improved Communication	
19	Communication & Collaboration	Improved Collaboration Between Organizations	
20	Communication & Collaboration	Reduced Conflict	An actual reduction in conflict.
21	Communication & Collaboration	Improved Conflict Management	Improved management of conflict.
22	Communication & Collaboration	Improved Coordination of Tasks and Work	
23	Communication & Collaboration	Enhanced Knowledge of Teamwork Principles	
24	Communication & Collaboration	Improved Teamwork	
25	Cost/Time	Enhanced Accuracy of Budgeting	Generation of budgets that are closer to actual execution costs.
26	Cost/Time	Improved Budget Control	Enhanced budget control allows organizations to more successfully constrain the growth of project budgets.
27	Cost/Time	Improved Budgeting	Improved budgeting allows projects to be budgeted to optimize cost-efficiency and resource utilization.
28	Cost/Time	Improved Speed of Cash Flow	
29	Cost/Time	Reduced Project, Program, Portfolio, and Overhead Costs	Decreased project, program, portfolio, and overhead costs.
30	Cost/Time	Improved Cost Management and Control	Enhanced management and control of costs.
31	Cost/Time	Reduced Cost Overruns	
32	Cost/Time	Improved Cost Performance	
33	Cost/Time	Improved Estimating	Improved quality, accuracy, and speed of estimates.
34	Cost/Time	Improved Forecasting	Improved ability to forecast project schedule and cost.
35	Cost/Time	Improved Project and Program Planning	
36	Cost/Time	Improved Profitability	
37	Cost/Time	Reduced Project Throughput Time	Reduced project durations. Reduced project durations accelerate cash flow and allow more projects to be executed.

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
38	Cost/Time	Reduced Cost Performance Index (CPI) Variances	
39	Cost/Time	Reduced Schedule Performance Index (SPI) Variances	
40	Cost/Time	Improved Ability to Model Revenue and Cash Flow	
41	Cost/Time	Improved Schedule Realism	Creation of more realistic project schedules.
42	Cost/Time	Improved Scheduling	Improved ability to schedule projects.
43	Cost/Time	Increased Ability to Meet Project and Program Deadlines	
44	Effectiveness and Efficiency	Expanded Participant Job Performance Capabilities	
45	Effectiveness and Efficiency	Improved Effectiveness of Individuals	
46	Effectiveness and Efficiency	Improved Effectiveness of Project Teams	
47	Effectiveness and Efficiency	Improved Efficiency of Individuals	
48	Effectiveness and Efficiency	Improved Efficiency of Project Teams	
49	Effectiveness and Efficiency	Improved Job Behavior and Productive Employee Conduct	
50	Effectiveness and Efficiency	Improved Trainee Job Performance	
51	Effectiveness and Efficiency	Reduced Number of Trainee Mistakes	
52	Effectiveness and Efficiency	Improved Productivity in Individuals	Training is widely used to improve productivity in individuals (Galanou & Priporas, 2009).
53	Effectiveness and Efficiency	Improved Productivity in Project Teams	
54	Effectiveness and Efficiency	Increased Revenue Per Employee	
55	Effectiveness and Efficiency	Improved Subjective Job Performance	Feelings of improved job performance after training
56	Effectiveness and Efficiency	Improved Computer and Software Skills	

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
57	Knowledge Management	Improved Ability to Perform Analysis on Project, Program, and Portfolio Data	This benefit also applies to data from actual, proposed, and historical initiatives.
58	Knowledge Management	Improved Decision Making in Individuals, Project Teams, and at the Organization Level	
59	Knowledge Management	Improved Declarative Knowledge in Training Participants	Declarative knowledge refers to knowledge about facts and things. For example, knowing that apples grow on trees.
60	Knowledge Management	Improved Documentation Management	Improved management of project, program, and portfolio documentation.
61	Knowledge Management	Improved Speed and Ease of Access to Project, Program, and Portfolio Information	
62	Knowledge Management	Improved Flow of Information	
63	Knowledge Management	Increased Innovation in Training Participants	
64	Knowledge Management	Improved Knowledge Management	Useful information is securely managed for use on current and future endeavors
65	Knowledge Management	Achievement of Targeted Participant Knowledge Outcomes	Knowledge objectives achieved as the result of training.
66	Knowledge Management	Incorporation of Lessons Learned from Past Experience into Current and Future Projects, Programs, and Portfolios	
67	Knowledge Management	Improved Problem Solving	
68	Knowledge Management	Improved Procedural Knowledge	Procedural knowledge refers to knowledge related to how to perform specific tasks.
69	Knowledge Management	Improved Project Management Competence in Individuals	

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
70	Knowledge Management	Improved Reporting of Project, Program, and Portfolio Data	The ability to quickly produce meaningful data, based on complete and current information. Reports can be tailored for individual stakeholders and presented in a convenient format (i.e. project dashboards). Reports can be generated to show trends and can be created in a variety of formats (i.e. tabular, graphical, etc.) to aid in conveying the intended information or drawing attention to problems.
71	Knowledge Management	Improved Strategic Knowledge	Strategic knowledge refers to knowing when to apply a specific skill or knowledge.
72	Knowledge Management	Successful Use of Templates for Project Planning and Generating Reports	
73	Market Presence	Increased Organizational Competitiveness	
74	Market Presence	Expansion of Customer Base	
75	Market Presence	Increased Market Share	Increased share of customers within the marketplace.
76	Market Presence	Development of New Markets for Products and Services	
77	Market Presence	Improved Identification of Business Opportunities	Identification of internal business opportunities (i.e. to develop new products or services or perform upgrades), or opportunities to perform new or additional services for clients.
78	Market Presence	Improved Organizational Reputation	
79	Market Presence	Improved Organizational Visibility within the Market	
80	Market Presence	Prepare and Position the Organization for Future Work	
81	Market Presence	Improved Sales	
82	Performance	Improved Attainment of Project/Program Scope	
83	Performance	Improved Establishment of Project/Program Baselines	
84	Performance	Improved Business Performance	
85	Performance	Reduced Project and Program Change During Execution	

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
86	Performance	Improved Change Management Practices	Improved ability to control change, track and audit changes, and incorporate improved changes into existing projects and programs.
87	Performance	Improved Consistency of Project Outcomes	
88	Performance	Improved Ability to Easily Integrate Future Work into System	
89	Performance	Improved Effectiveness of Project/Program Management	
90	Performance	Improved Execution According to Plan	
91	Performance	Improved Financial Performance	
92	Performance	Improved Monitoring and Control	
93	Performance	Improved Organization of Project/Program Work	
94	Performance	Development and Implementation of Enhanced Performance Measurement Metrics	
95	Performance	Enhanced Portfolio Performance Management	
96	Performance	Improved Ability to Successfully Implement Preventative and Corrective Actions	
97	Performance	Achievement of Project and Program Success; Goals and Objectives Met; and Outcomes/Benefits Realized	Improved ability to successfully complete projects and programs, where objectives (example: cost and schedule goals) are satisfied, and the targeted outcomes and benefits are realized.
98	Performance	Improved Project Performance	Actual improved performance of projects.
99	Performance	Enhanced Project Performance Management	Improved insight into project performance and ability to manage projects based on performance data.
100	Performance	Improved Quality of Deliverables or Project Products	Improved deliverable quality.
101	Performance	Improved Quality Management	Improved management of quality.
102	Performance	Improved Quality of Work in Individuals	
103	Performance	Reduction of Rework in Projects and Programs	
104	Performance	Improved Reliability of Delivery	Improved ability to deliver project outcomes in accordance with project and program objectives.
105	Performance	Improved Requirements Management	Improved management of requirements in projects and programs.

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
106	Performance	Increased Revenue	
107	Performance	Improved Scope Management	
108	Resource Management	Positive Professional Development of Employees toward Career Advancement	
109	Resource Management	Improved Management of Financial Resources	
110	Resource Management	Improved Management of Human Resources	
111	Resource Management	Increased Time and Attention to Spend on Projects, More Control Over Time at Individual Level, and Improved Work-Life Balance	Resources can devote more time and attention to initiatives, better control their own time, and enjoy a better work-life balance when low-value projects and projects with redundant goals are eliminated.
112	Resource Management	Improved Materials Management	
113	Resource Management	Improved Procurement of Resources	Managing procurement through a centralized system that is connected to the organization's projects improves the ability of the organization to plan and execute procurement. Benefits like improved economies of scale can be realized by purchasing for multiple projects at one time.
114	Resource Management	Improved Resource Allocation	
115	Resource Management	Improved Balance of Resource Capacity with Demand	
116	Resource Management	Improved Resource Management	General improvement in resource management. This includes optimizing the allocation of shared resources, reduced conflict for resources, improved scheduling of materials etc.
117	Resource Management	Improved Resource Utilization	
118	Resource Management	Return of Allocated, but Unused Funding to the Performing Organization	

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
119	Risk	Reduced Organizational Risk	Actual reduced to the overall organization. This can be achieved by improving the balance of risk in project portfolios and eliminating unnecessarily risky projects.
120	Risk	Reduced Project, Program, and Portfolio Risk	Actual reduced project, program, and portfolio risk.
121	Risk	Improved Risk/Issue Management in Projects and Programs	Improved capability to manage risks and issues.
122	Stakeholder Management	Improved Customer Relations and Customer Satisfaction	
123	Stakeholder Management	Improved Customer Service	
124	Stakeholder Management	Increased Employee Satisfaction	
125	Stakeholder Management	Reduced Employee Turnover	
126	Stakeholder Management	Improved Stewardship of Customer Funds	
127	Stakeholder Management	Improved Satisfaction of Management	
128	Stakeholder Management	Increased Organizational Commitment	
129	Stakeholder Management	Improved Owner/Shareholder Satisfaction	
130	Stakeholder Management	Positive Reaction to Training in Participants	
131	Stakeholder Management	Improved Engagement of Stakeholders	
132	Stakeholder Management	Improved Stakeholder Management	Generally improved stakeholder management.
133	Stakeholder Management	Value Created for Subcontractors/Suppliers	
134	Strategic and Enterprise	Improved Alignment of Projects and Programs with Organizational Objectives	
135	Strategic and Enterprise	Positively Contributing to the Identification, Documentation, Management Toward, and Realization of Targeted Program Benefits	
136	Strategic and Enterprise	Improved Project Management and Business Processes	

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
137	Strategic and Enterprise	Continuous Improvement within the Organization	
138	Strategic and Enterprise	Improved Dialog within the Organization	
139	Strategic and Enterprise	Improved Organizational Effectiveness	Effectiveness at achieving organizational goals
140	Strategic and Enterprise	Improved Governance	
141	Strategic and Enterprise	Improved Ability to Successfully Manage Organizational Change (i.e. Growth)	
142	Strategic and Enterprise	Improved Credibility of the Organization to Deliver According to Objectives	
143	Strategic and Enterprise	Improved Management of Internal Projects	
144	Strategic and Enterprise	Improved or Strengthened Leadership	Implementation of a formal project management methodology may contribute to strengthened and improved leadership. Training has also been shown to effectively improve leadership capabilities.
145	Strategic and Enterprise	Elimination of Low-Value Projects, and Projects with Redundant Goals.	
146	Strategic and Enterprise	Improved Management of Projects and Programs in Accordance with Established Organizational Policy	
147	Strategic and Enterprise	Improved Meetings	Levine (2005) states that Project Portfolio Management can promote increased meeting effectiveness and generate increased involvement.
148	Strategic and Enterprise	Elimination of Unnecessary Meetings	Since project, program, and portfolio data can be freely transmitted, many meetings are made obsolete and can be eliminated.
149	Strategic and Enterprise	Improved Management of Multiple Projects and Programs	Improved ability to manage simultaneous projects.
150	Strategic and Enterprise	Improved Adaptability and Agility of the Organization	

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
151	Strategic and Enterprise	Improved Organizational Capabilities	New or enhanced capabilities within the organization. For example, new technical capabilities or improved project management capability.
152	Strategic and Enterprise	Improved Organizational Capacity for Work.	
153	Strategic and Enterprise	Positive Organizational Change	
154	Strategic and Enterprise	Improved Efficiency at the Organizational Level.	Improved efficiency within the organization. For example, increased adoption of streamlined business processes can improve efficiency across the organization.
155	Strategic and Enterprise	Formal Establishment, or Improvement of Established Organizational Mission	
156	Strategic and Enterprise	Improved Selection, Prioritization, and Delivery of Organizational Objectives	
157	Strategic and Enterprise	Formal Establishment, or Improvement of Established Organizational Priorities	
158	Strategic and Enterprise	Improvement in Organizational Strategy	
159	Strategic and Enterprise	Positive Organizational Transformation	
160	Strategic and Enterprise	Improved Analysis of the Potential Projects for the Project Pipeline	
161	Strategic and Enterprise	Improved Ability to Adjust Portfolios Based on Performance, Risk, Resource Constraints, Organizational Goals, and Market Conditions	Adjusting the portfolio to maximize the return to the organization can entail delaying, restructuring or terminating projects with performance problems or projects that are no longer aligned with the organization's objectives.
162	Strategic and Enterprise	Improved Portfolio Balance	
163	Strategic and Enterprise	Development of New Products	

Table 19: Twelve Areas of Impact – Composition

No.	Area of Benefit	Description of Benefit	Notes about Benefit
164	Strategic and Enterprise	Improved Organizational Productivity	Kaiser & Ahlemann (2010) suggest that using project, program, and portfolio management software positively impacts organizational productivity. Many studies have shown that training increases organizational productivity (Aguinis & Kraiger, 2009).
165	Strategic and Enterprise	Improved Project Accounting	
166	Strategic and Enterprise	Improved Project Accounting Practices	
167	Strategic and Enterprise	Permeation of Project Management Principles within the Organization	
168	Strategic and Enterprise	Improved Prioritization and Selection of Potential Projects and Programs	
169	Strategic and Enterprise	Improved Quality of Life	
170	Strategic and Enterprise	Ability to Realize Project Value	
171	Strategic and Enterprise	Standardization of Project Management Practices Across the Organization	
172	Strategic and Enterprise	Positive Chance in Work Culture	

Publications Cited in Discipline Literature Analysis

Table 20: Literature by Discipline

No.	Publication Author and Year	PMIS	Training	PM	Additional Signif. Contrib.
1	Raymond & Bergeron (2008)	X			
2	(Bednarz & Dubie, 2006)	X			
3	(Symons, 2009)	X			
4	(Rapport, 2009)	X			
5	Kaiser & Ahlemann (2010)	X			X
6	Callaghan, 2003	X			
7	Project Management Software. (2006). [Article]. EC&M Electrical Construction & Maintenance, 105(3), C8-C9.	X			
8	PMBOK, 4th Edition	X			
9	Kerzner, 2006	X			
10	Ali, Anbari, & Money, 2008	X			X
11	Bērziša, 2009	X			X
12	Bērziša & Grabis, 2010	X			X
13	(Ciftci, 2007)	X			
14	(Fabac et al., 2010)	X			
15	(Feldman, 2007)	X			
16	(Feldman & Feldman, 2005)	X			
17	(Fox & Spence, 1998)	X			X
18	(Herroelen, 2005)	X			X
19	(Kaiser & Ahlemann, 2010)	X			
20	(Lawton, 2000)	X			
21	(Liberatore & Pollack-Johnson, 2003)	X			X
22	(Milosevic & Patanakul, 2005)	X			X
23	(Setzer & Bonafair, 2004)	X			
24	(Visitacion & DeGennaro, 2009)	X			
25	(Watkins, 2008)	X			
26	(Raz & Michael, 2001)	X			X
27	(Tombros & Mohan, 2008)	X			
28	(Mantel, 2005)	X			X
29	(Kastel, 2009)	X			X
30	(Levine, 2005)	X			X
31	(Project Management Institute., 2008)	X			X
32	PMI Practice Standard for Scheduling, Second Edition, 2008	X			
33	Aguinis & Kraiger, 2009		X		X
34	(Atkins & Gilbert, 2003)		X		X
35	(Ayas, 1996)		X		
36	(Baron & Morin, 2009)		X		
37	Bedwell & Salas, 2010		X		X
38	(Bohlen & Ferratt, 1993)		X		

Table 20: Literature by Discipline

No.	Publication Author and Year	PMIS	Training	PM	Additional Signif. Contrib.
39	Bulut & Culha, 2010		X		X
40	(Brown & McCracken, 2010)		X		
41	(Clarke, 2010)		X		X
42	Coppola & Myre, 2002		X		
43	Dearden, Reed, & Van Reenen, 2000		X		
44	(Facteau, Dobbins, Russell, Ladd, & Kudisch, 1995)		X		X
45	(Galanou & Priporas, 2009)		X		X
46	(Guglielmino & Murdick, 1997)		X		X
47	(Gupta & Bostrom, 2006)		X		X
48	(Gupta, Bostrom, & Huber, 2010)		X		X
49	(Harris, 1995)		X		X
50	(IBM, 2008)		X		X
51	(IBM, 2008) - The Value of Training		X		
52	(Land, Tan, & Bin, 2005)		X		
53	(Leach & Liu, 2003)		X		X
54	(McCreery, 2003)		X		
55	(Mengel, 2008)		X		
56	(Michel et al., 2007)		X		
57	(Nelson & Cheney, 1987)		X		X
58	(Paradise, 2008)		X		
59	(Paradise & Patel, 2009)		X		
60	(Phillips, 1996)		X		
61	(Salas & Cannon-Bowers, 2001)		X		X
62	(Sitzmann, Kraiger, Stewart, & Wisher, 2006)		X		X
63	(Tannenbaum & Yukl, 1992)		X		X
64	(Wearne, 2008)		X		X
65	(Wouters, Paas, & van Merriënboer, 2008)		X		
66	(Yi & Davis, 2003)		X		X
67	(Yong-Kean & Teck-Hong, 2010)		X		X
68	(Frayne & Geringer, 2000)		X		X
69	(Colquitt, LePine, & Noe, 2000)		X		
70	(Thomas & Mullaly, 2008)			X	X
71	(Ibbs & Reginato, 2002)			X	X
72	(Crawford & Helm, 2009)			X	
73	(Mullaly & Thomas, 2009)			X	
74	(Partington, 1996)			X	
75	(Pellegrinelli, Partington, Hemingway, Mohdzain, & Shah, 2007)			X	X
76	(Reyck et al., 2005)			X	X
77	(Shi, 2010)			X	X
78	(Thomas & Mullaly, 2007)			X	X
79	(J. L. Thomas & Mullaly, 2009)			X	
80	(Turner, Ledwith, & Kelly, 2010)			X	X

Table 20: Literature by Discipline

No.	Publication Author and Year	PMIS	Training	PM	Additional Signif. Contrib.
81	(Vahaniitty, Rautiainen, & Lassenius, 2010)			X	X
82	(Zhai, Xin, & Cheng, 2009)			X	X
83	(Aubry & Hobbs, 2011)			X	X
84	(Hurt & Thomas, 2009)			X	X
85	(Eskerod & Riis, 2009)			X	
86	(Andersen & Vaagaasar, 2009)			X	
87	PMI - The standard for program management, 2008			X	
88	PMI - Standard for program management, 2008			X	
89	PMI - The standard for program management, 2005			X	
90	PMI - The standard for program management, 2006			X	
91	PMI - The standard for program management, 2007			X	
92	Standard for Program Mgmt			X	
93	PMI - The standard for program management, 2009			X	
94	PMI - The standard for program management, 2010			X	
95	PMI - The standard for program management, 2011			X	X
96	PMI - The standard for portfolio management, 2008			X	X
97	Standard for Portfolio Mgmt			X	
98	OPM3, 2nd Edition			X	X
99	Brown & McCracken, 2010				X
100	Clarke & Nicholas, 2010				X
101	Clarke, 2010				X
102	Dierdorff, Erich C. Surface, Eric A., 2008				X
103	Bednarz & Dubie, 2006				X
104	(Cao & Hoffman, 2011)				X
105	(Cooke-Davies, Crawford, & Lechler, 2009)				X
106	(Milosevic & Patanakul, 2005)				X
107	(Parson, 2002)				X
108	(Derouin, Fritzsche, & Salas, 2004)				X
109	(Dierdorff & Surface, 2008)				X
110	(Garavan, Carbery, O'Malley, & O'Donnell, 2010)				X
111	(Granger & Levine, 2010)				X
112	(Greder, Diers, & Schnurr, 2010)				X
113	(Laoledchai, Land, & Low, 2008)				X
114	(Schmeeckle, 2003)				X
115	(C. Ibbs & Kwak, 2000)				X
116	(Strother, 2002)				X
117	(Tsoukanas, 1995)				X
118	(Utgaard & Dawis, 1970)				X
119	(Ward, 1999)				X
120	(Wateridge, 1997)				X
121	(Westcott-Abudi, 2008)				X
122	(Wu & Rocheleau, 2001)				X
123	(Zimmerman, 2001)				X

Table 20: Literature by Discipline

No.	Publication Author and Year	PMIS	Training	PM	Additional Signif. Contrib.
124	(Pant & Baroudi, 2008)				X
125	(Pellegrinelli, 2011)				X

Publications Cited in Composition of Framework Elements

Accountability:

Benefits to Individuals:

(Raymond & Bergeron, 2008). (Rapport, 2009).

Benefits to Workgroups:

(Kaiser & Ahlemann, 2010). (Eskerod & Riis, 2009)

Benefits to Organizations:

(Bednarz & Dubie, 2006; Kastel, 2009). (Rapport, 2009). (Kerzner, 2006). (Watkins, 2008). (J. Thomas & Mullaly, 2008). (Crawford & Helm, 2009) (Reyck, et al., 2005). (Turner, et al., 2010). (Eskerod & Riis, 2009). (Levine, 2005). (Project Management Institute., 2008d), (Project Management Institute., 2008c). (Project Management Software, 2006). (Kastel, 2009).

Attitude

Benefits to Individuals:

(Aguinis & Kraiger, 2009; Frayne & Geringer, 2000). (Baron & Morin, 2009). (J. Phillips, 1996). (S. Gupta & Bostrom, 2006). (Nelson & Cheney, 1987). (Galanou & Priporas, 2009). (Brown & McCracken, 2010). (Tannenbaum & Yukl, 1992). (Bedwell & Salas, 2010).

(Nelson & Cheney, 1987).

Benefits to Workgroups:

(Galanou & Priporas, 2009). (Aguinis & Kraiger, 2009). (Colquitt, et al., 2000; Yi & Davis, 2003). (Wearne, 2008).

Benefits to Organizations:

(IBM, 2008b). (Nelson & Cheney, 1987). (Levine, 2005). (Harris, 1995). (J. Phillips, 1996). (Bedwell & Salas, 2010; E Salas, et al., 1995). (Bulut & Culha, 2010). (Facteau, et al., 1995).

Communication & Collaboration

Benefits to Individuals:

(Aguinis & Kraiger, 2009). (Tannenbaum & Yukl, 1992).

Benefits to Workgroups:

(Visitacion & DeGennaro, 2009).(Kaiser & Ahlemann, 2010). (Callaghan, 2003). (Mantel, 2005). (Aguinis & Kraiger, 2009; Ellis, et al., 2005).

(Clarke, 2010). (Galanou & Priporas, 2009). (Eduardo Salas & Cannon-Bowers, 2001) (Tannenbaum & Yukl, 1992) (Aguinis & Kraiger, 2009).

Benefits to Organizations:

(Herroelen, 2005) (Levine, 2005). (Mantel, 2005). (Project Management Software, 2006). (Project Management Software, 2006). (Project Management Institute., 2008a). (Feldman & Feldman, 2005).

(Kastel, 2009). (J. Thomas & Mullaly, 2008). (Pellegrinelli, et al., 2007). (Reyck, et al., 2005) (J. L. Thomas & Mullaly, 2009). (Turner, et al., 2010). (Zhai, et al., 2009). (Eskerod & Riis, 2009). (Andersen & Vaagaasar, 2009). (Bulut & Culha, 2010). (Eduardo Salas & Cannon-Bowers, 2001)

Cost/Time

Benefits to Individuals:

(Kaiser & Ahlemann, 2010). (Kerzner, 2006). (Feldman & Feldman, 2005). (Tombros & Mohan, 2008) .

Benefits to Workgroups:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Organizations:

(Raymond & Bergeron, 2008). (Levine, 2005). (Symons, 2009). (Kaiser & Ahlemann, 2010). (Project Management Institute., 2008a). (Kerzner, 2006). (Feldman, 2007). (Lawton, 2000).

(Setzer & Bonafair, 2004). (Kastel, 2009). (Aguinis & Kraiger, 2009) (IBM, 2008b). (J. Phillips, 1996).

Effectiveness and Efficiency

Benefits to Individuals:

(Raymond & Bergeron, 2008) (Symons, 2009). (Ali, et al., 2008). (Aguinis & Kraiger, 2009). (Ayas, 1996). (Bohlen & Ferratt, 1993). (Coppola & Myre, 2002). (Galanou & Priporas, 2009). (Land, et al., 2005). (Michel, et al., 2007, October). (Nelson & Cheney, 1987). (J. Phillips, 1996). (Tannenbaum & Yukl, 1992). (Yi & Davis, 2003).

Benefits to Workgroups:

(Kaiser & Ahlemann, 2010). (Feldman & Feldman, 2005). (Aguinis & Kraiger, 2009). (Atkins & Gilbert, 2003).

Benefits to Organizations:

(Levine, 2005). (Project Management Software, 2006). (Bedwell & Salas, 2010). (Dearden, et al., 2000). (Galanou & Priporas, 2009).

Knowledge Management

Benefits to Individuals:

(Kaiser & Ahlemann, 2010). (Kerzner, 2006). (Lawton, 2000). (Tombros & Mohan, 2008). (Kastel, 2009). (Aguinis & Kraiger, 2009). (Galanou & Priporas, 2009). (Harris, 1995). (McCreery, 2003). (Mengel, 2008). (Sitzmann, et al., 2006). (Wouters, et al., 2008).

Benefits to Workgroups:

(Project Management Software, 2006). (Feldman, 2007). (Watkins, 2008). (Aguinis & Kraiger, 2009).

Benefits to Organizations:

(Levine, 2005). (Bednarz & Dubie, 2006). (Rapport, 2009). (Kaiser & Ahlemann, 2010). (Callaghan, 2003). (Project Management Software, 2006). (Project Management Institute., 2008a). (Kerzner, 2006).

(Feldman & Feldman, 2005). (Lawton, 2000). (Setzer & Bonafair, 2004). (Visitacion & DeGennaro, 2009). (Watkins, 2008). (Mantel, 2005). (Kastel, 2009). (J. Phillips, 1996).

Market Presence

Benefits to Individuals:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Workgroups:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Organizations:

(Project Management Software, 2006). (Feldman & Feldman, 2005). (Kastel, 2009). (Aguinis & Kraiger, 2009) (Galanou & Priporas, 2009). (Harris, 1995). (Leach & Liu, 2003).

Strategic and Enterprise

Benefits to Individuals:

(Kaiser & Ahlemann, 2010). (Baron & Morin, 2009).

Benefits to Workgroups:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Organizations:

(Levine, 2005). (Bednarz & Dubie, 2006). (Symons, 2009). (Kaiser & Ahlemann, 2010). (Project Management Software, 2006). (Kerzner, 2006). (Lawton, 2000). (Milosevic & Patanakul, 2005). (Setzer & Bonafair, 2004). (Visitacion & DeGennaro, 2009). (Watkins, 2008). (Mantel, 2005). (Kastel, 2009). (Eduardo Salas & Cannon-Bowers, 2001). (Tannenbaum & Yukl, 1992).

Performance

Benefits to Individuals:

(Kerzner, 2006). (Ali, et al., 2008). (Aguinis & Kraiger, 2009).

Benefits to Workgroups:

(Aguinis & Kraiger, 2009).

Benefits to Organizations:

(Raymond & Bergeron, 2008). (Symons, 2009). (Kaiser & Ahlemann, 2010). (Project Management Institute., 2008a). (Feldman, 2007). (Watkins, 2008). (Mantel, 2005). (Levine, 2005). (Project Management Institute., 2011). (Aguinis & Kraiger, 2009) (Bedwell & Salas, 2010). (Galanou & Priporas, 2009). (J. Phillips, 1996). (Yong-Kean & Teck-Hong, 2010).

Resource Management

Benefits to Individuals:

(Kaiser & Ahlemann, 2010).

Benefits to Workgroups:

(Mantel, 2005).

Benefits to Organizations:

(Project Management Institute., 2008a). (Feldman & Feldman, 2005). (Mantel, 2005). (Kastel, 2009). (Levine, 2005) (Project Management Institute., 2011) . (IBM, 2008b). (J. Phillips, 1996).

Risk

Benefits to Individuals:

(Wearne, 2008).

Benefits to Workgroups:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Organizations:

(Kerzner, 2006). (Raz & Michael, 2001). (Mantel, 2005). (Kastel, 2009). (Levine, 2005).

Stakeholder Management

Benefits to Individuals:

(Aguinis & Kraiger, 2009) . (Harris, 1995).

Benefits to Workgroups:

Positive beneficial impacts were not observed within this general area of impact at this level (I,W,O).

Benefits to Organizations:

(Pellegrinelli, et al., 2007). (Kaiser & Ahlemann, 2010). (Feldman, 2007). (Watkins, 2008). (Mantel, 2005). (Levine, 2005). (Aguinis & Kraiger, 2009) (Bulut & Culha, 2010). (Galanou & Priporas, 2009). (Harris, 1995). (IBM, 2008b). (Leach & Liu, 2003). (Paradise, 2008). (Paradise & Patel, 2009). (Tannenbaum & Yukl, 1992).

Expert Input Statistics

Table 21: Current Expert Primary Role or Roles:

Present Role / Expert No.	1	2	3	4	5	6	7	8	9	Total
Executive Leadership		Yes							Yes	2
Director of PM/PMO		Yes								1
Portfolio Manager		Yes			Yes					2
Program Manager		Yes								1
Project Manager		Yes	Yes				Yes		Yes	4
Scheduling Professional		Yes								1
PM Specialist		Yes					Yes	Yes	Yes	4
Functional Manager		Yes	Yes	Yes						3
PM Consultant	Yes					Yes	Yes	Yes	Yes	5
Educator/Trainer						Yes			Yes	2
Researcher										0
Project Contributor (i.e. Engineer, etc.)	Yes								Yes	2
Other - If Used, Please Define Below						Yes				1
(Optional) Other Role 1:					Yes	Yes		Yes		3
(Optional) Other Role 2:								Yes		1
(Optional) Other Role 3:										0

Table 22: Past Expert Primary Role or Roles:

Past Roles / Expert No.	1	2	3	4	5	6	7	8	9	Total
Executive Leadership				Yes						1
Director of PM/PMO		Yes								1
Portfolio Manager			Yes							1
Program Manager	Yes		Yes					Yes	Yes	4
Project Manager	Yes	Yes	Yes	Yes			Yes	Yes	Yes	7
Scheduling Professional	Yes	Yes	Yes				Yes			4
PM Specialist	Yes	Yes	Yes				Yes		Yes	5
Functional Manager		Yes	Yes	Yes			Yes		Yes	5
PM Consultant			Yes	Yes			Yes		Yes	4
Educator/Trainer	Yes		Yes	Yes					Yes	4
Researcher	Yes		Yes						Yes	3
Project Contributor (i.e. Engineer, etc.)				Yes					Yes	2

Table 22: Past Expert Primary Role or Roles:

Past Roles	Expert No.	1	2	3	4	5	6	7	8	9	Total
Other - If Used, Please Define Below											0
(Optional) Other Role 1:				Yes							1
(Optional) Other Role 2:											0
(Optional) Other Role 3:											0

Table 23: Cumulative Expert Experience - Primary Role or Roles

Past and Present Roles	Expert No.	1	2	3	4	5	6	7	8	9	Total
Executive Leadership			yes		yes					yes	3
Director of PM/PMO			yes								1
Portfolio Manager			yes	yes		yes					3
Program Manager		yes	yes	yes					yes	yes	5
Project Manager		yes	yes	yes	yes			yes	yes	yes	7
Scheduling Professional		yes	yes	yes				yes			4
PM Specialist		yes	yes	yes				yes	yes	yes	6
Functional Manager			yes	yes	yes			yes		yes	5
PM Consultant		yes		yes	yes		yes	yes	yes	yes	7
Educator/Trainer		yes		yes	yes		yes			yes	5
Researcher		yes		yes						yes	3
Project Contributor (i.e. Engineer, etc.)		yes			yes					yes	3
Other - If Used, Please Define Below							yes				1
(Optional) Other Role 1:				yes		yes	yes		yes		4
(Optional) Other Role 2:									yes		1
(Optional) Other Role 3:											0

Table 24: Expert Evaluation of Benefits from Literature

No.	Benefit Identified in Literature	Rank	Avg.	Expert No. 1	2	3	4	5	6	7	8	9
70	Improved Reporting of Project, Program, and Portfolio Data	1	5.889	3	5	6	5	7	7	7	7	6
149	Improved Management of Multiple Projects and Programs	2	5.778	6	7	4	6	6	6	4	7	6
22	Improved Coordination of Tasks and Work	3	5.667	6	6	6	5	6	6	4	6	6
58	Improved Decision Making in Individuals, Project Teams, and at the Organization Level	3	5.667	5	4	6	6	7	6	5	6	6
61	Improved Speed and Ease of Access to Project, Program, and Portfolio Information	3	5.667	4	4	6	6	7	7	5	6	6
87	Improved Consistency of Project Outcomes	3	5.667	5	5	4	5	6	6	7	7	6
11	Faster Adoption of Technology	7	5.556	5	5	6	7	5	6	3	7	6
42	Improved Scheduling	7	5.556	5	5	5	6	5	7	4	7	6
62	Improved Flow of Information	7	5.556	5	4	6	5	5	7	5	7	6
72	Successful Use of Templates for Project Planning and Generating Reports	7	5.556	5	6	5	1	6	7	7	7	6
82	Improved Attainment of Project/Program Scope	7	5.556	5	6	5	5	6	6	4	7	6
46	Improved Effectiveness of Project Teams	12	5.444	5	6	5	6	5	7	3	6	6
57	Improved Ability to Perform Analysis on Project, Program, and Portfolio Data	12	5.444	4	4	6	5	6	7	5	6	6
83	Improved Establishment of Project/Program Baselines	12	5.444	5	5	5	5	5	7	4	7	6
92	Improved Monitoring and Control	12	5.444	5	5	5	5	6	6	4	7	6
93	Improved Organization of Project/Program Work	12	5.444	5	6	5	5	6	5	4	7	6
10	Improved Support for the Organization's Project, Program, and Portfolio Management Practices	17	5.333	5	6	6	7	6	6	1	5	6
35	Improved Project and Program Planning	17	5.333	5	6	6	6	5	6	1	7	6
48	Improved Efficiency of Project Teams	17	5.333	5	6	5	6	4	7	3	6	6
114	Improved Resource Allocation	17	5.333	5	6	5	5	6	5	4	6	6
116	Improved Resource Management	17	5.333	5	6	5	5	6	5	4	6	6
18	Improved Communication	22	5.222	5	6	6	2	5	6	4	7	6
29	Reduced Project, Program, Portfolio, and Overhead Costs	22	5.222	2	4	6	3	7	7	5	7	6
33	Improved Estimating	22	5.222	6	6	5	6	5	6	1	7	5
34	Improved Forecasting	22	5.222	4	6	5	6	5	7	1	7	6
43	Increased Ability to Meet Project and Program Deadlines	22	5.222	5	5	5	6	5	5	4	6	6

Table 24: Expert Evaluation of Benefits from Literature

No.	Benefit Identified in Literature	Rank	Avg.	Expert No. 1	2	3	4	5	6	7	8	9
89	Improved Effectiveness of Project/Program Management	22	5.222	5	5	5	5	5	6	4	6	6
3	Improved Delegation of Tasks and Responsibilities	28	5.111	5	6	5	6	5	6	1	6	6
19	Improved Collaboration Between Organizations	28	5.111	5	6	6	2	5	6	4	6	6
47	Improved Efficiency of Individuals	28	5.111	4	5	5	6	4	7	3	6	6
53	Improved Productivity in Project Teams	28	5.111	5	6	5	5	5	6	3	5	6
56	Improved Computer and Software Skills	28	5.111	5	4	4	6	5	6	4	6	6
69	Improved Project Management Competence in Individuals	28	5.111	5	6	5	6	6	5	1	6	6
143	Improved Management of Internal Projects	28	5.111	5	6	5	5	6	5	1	7	6
145	Elimination of Low-Value Projects, and Projects with Redundant Goals.	28	5.111	3	6	4	4	7	5	4	6	7
146	Improved Management of Projects and Programs in Accordance with Established Organizational Policy	28	5.111	5	6	5	4	4	6	4	6	6
1	Improved Accountability	37	5.000	4	6	7	3	4	4	5	6	6
2	Improved Ability to Audit Data and Comply with Regulations	37	5.000	4	5	7	2	6	6	3	6	6
4	Improved Clarity of Individual Roles, Responsibilities, and Organizational Structures	37	5.000	5	6	5	5	5	5	3	6	5
24	Improved Teamwork	37	5.000	6	6	6	1	5	5	3	6	7
25	Enhanced Accuracy of Budgeting	37	5.000	2	4	4	5	4	6	7	7	6
26	Improved Budget Control	37	5.000	2	5	4	2	6	6	7	7	6
27	Improved Budgeting	37	5.000	2	4	4	4	6	5	7	7	6
88	Improved Ability to Easily Integrate Future Work into System	37	5.000	4	5	5	2	6	7	4	6	6
90	Improved Execution According to Plan	37	5.000	5	5	4	5	5	5	4	6	6
95	Enhanced Portfolio Performance Management	37	5.000	3	6	5	2	6	6	4	7	6
98	Improved Project Performance	37	5.000	5	6	5	3	5	6	4	5	6
160	Improved Analysis of the Potential Projects for the Project Pipeline	37	5.000	6	6	3	2	6	7	3	6	6
171	Standardization of Project Management Practices Across the Organization	37	5.000	5	7	3	5	5	6	1	7	6
17	Improved Collaboration among Individuals and Teams	50	4.889	5	6	6	2	5	4	4	6	6
30	Improved Cost Management and Control	50	4.889	2	4	5	3	6	6	5	7	6
41	Improved Schedule Realism	50	4.889	5	5	5	6	5	5	1	6	6
52	Improved Productivity in Individuals	50	4.889	5	5	5	5	5	6	3	5	5
84	Improved Business Performance	50	4.889	5	5	5	3	6	6	4	5	5
94	Development and Implementation of	50	4.889	5	5	5	2	6	5	4	7	5

Table 24: Expert Evaluation of Benefits from Literature

No.	Benefit Identified in Literature	Rank	Avg.	Expert No. 1	2	3	4	5	6	7	8	9
	Enhanced Performance Measurement Metrics											
99	Enhanced Project Performance Management	50	4.889	5	6	5	5	5	6	1	5	6
115	Improved Balance of Resource Capacity with Demand	50	4.889	5	5	5	5	6	5	1	6	6
154	Improved Efficiency at the Organizational Level.	50	4.889	5	6	4	4	5	6	3	6	5
161	Improved Ability to Adjust Portfolios Based on Performance, Risk, Resource Constraints, Organizational Goals, and Market Conditions	50	4.889	5	6	4	2	6	6	3	6	6
8	Improved Commitment to Objectives	60	4.778	5	5	6	4	6	5	1	6	5
73	Increased Organizational Competitiveness	60	4.778	5	6	4	1	7	7	1	6	6
86	Improved Change Management Practices	60	4.778	4	5	4	2	5	6	4	7	6
97	Achievement of Project and Program Success; Goals and Objectives Met; and Outcomes/Benefits Realized	60	4.778	5	6	5	3	5	6	1	6	6
134	Improved Alignment of Projects and Programs with Organizational Objectives	60	4.778	6	6	4	2	7	4	1	6	7
136	Improved Project Management and Business Processes	60	4.778	6	6	5	3	3	6	1	7	6
167	Permeation of Project Management Principles within the Organization	60	4.778	6	6	3	5	4	6	1	6	6
7	Improved Training Participant Attitudes	67	4.667	4	5	6	6	3	4	4	4	6
23	Enhanced Knowledge of Teamwork Principles	67	4.667	6	6	5	2	5	5	3	4	6
37	Reduced Project Throughput Time	67	4.667	4	4	5	5	6	5	1	7	5
59	Improved Declarative Knowledge in Training Participants	67	4.667	4	4	6	6	5	6	5	0	6
96	Improved Ability to Successfully Implement Preventative and Corrective Actions	67	4.667	5	6	4	1	5	5	4	6	6
111	Increased Time and Attention to Spend on Projects, More Control Over Time at Individual Level, and Improved Work-Life Balance	67	4.667	4	6	5	2	6	6	1	6	6
117	Improved Resource Utilization	67	4.667	5	6	5	5	0	5	4	6	6
147	Improved Meetings	67	4.667	4	3	4	2	7	6	4	6	6
151	Improved Organizational Capabilities	67	4.667	4	5	4	4	6	6	1	6	6
164	Improved Organizational Productivity	67	4.667	5	6	4	2	6	5	3	6	5
6	Improved Acceptance of Technology	77	4.556	4	5	4	6	5	5	3	4	5
20	Reduced Conflict	77	4.556	5	5	6	2	6	5	1	5	6
36	Improved Profitability	77	4.556	4	4	4	2	6	7	1	7	6

Table 24: Expert Evaluation of Benefits from Literature

No.	Benefit Identified in Literature	Rank	Avg.	Expert No. 1	2	3	4	5	6	7	8	9
45	Improved Effectiveness of Individuals	77	4.556	4	5	5	2	5	7	3	5	5
103	Reduction of Rework in Projects and Programs	77	4.556	4	6	5	2	5	6	1	6	6
104	Improved Reliability of Delivery	77	4.556	5	6	5	2	4	6	1	6	6
105	Improved Requirements Management	77	4.556	3	6	4	2	3	6	4	7	6
107	Improved Scope Management	77	4.556	5	5	5	2	4	6	1	7	6
150	Improved Adaptability and Agility of the Organization	77	4.556	5	5	2	5	6	6	1	6	5
156	Improved Selection, Prioritization, and Delivery of Organizational Objectives	77	4.556	5	6	4	3	6	4	1	6	6
162	Improved Portfolio Balance	77	4.556	4	6	3	2	6	5	3	6	6
170	Ability to Realize Project Value	77	4.556	5	5	2	5	4	5	3	6	6
13	Improved Motivation	89	4.444	5	4	2	6	6	5	3	5	4
14	Reduced Perceived Anxiety within Training Participants	89	4.444	5	5	4	6	6	6	3	0	5
39	Reduced Schedule Performance Index (SPI) Variances	89	4.444	6	4	5	4	5	5	1	5	5
64	Improved Knowledge Management	89	4.444	4	4	5	2	5	4	4	7	5
65	Achievement of Targeted Participant Knowledge Outcomes	89	4.444	5	4	5	5	5	6	4	0	6
68	Improved Procedural Knowledge	89	4.444	5	6	5	2	5	6	1	6	4
80	Prepare and Position the Organization for Future Work	89	4.444	5	6	4	1	6	5	1	6	6
85	Reduced Project and Program Change During Execution	89	4.444	4	4	5	6	4	6	1	6	4
100	Improved Quality of Deliverables or Project Products	89	4.444	5	6	4	2	5	6	1	5	6
119	Reduced Organizational Risk	89	4.444	5	6	4	1	5	5	1	7	6
121	Improved Risk/Issue Management in Projects and Programs	89	4.444	5	6	4	1	5	6	1	6	6
135	Positively Contributing to the Identification, Documentation, Management Toward, and Realization of Targeted Program Benefits	89	4.444	5	6	5	2	5	5	1	6	5
140	Improved Governance	89	4.444	5	5	4	1	7	5	1	6	6
142	Improved Credibility of the Organization to Deliver According to Objectives	89	4.444	5	6	4	1	6	5	1	6	6
168	Improved Prioritization and Selection of Potential Projects and Programs	89	4.444	4	7	2	3	6	5	1	6	6
172	Positive Chance in Work Culture	89	4.444	5	5	2	5	5	5	1	6	6
71	Improved Strategic Knowledge	105	4.333	5	5	0	2	6	7	1	7	6
109	Improved Management of Financial Resources	105	4.333	3	5	4	2	6	6	1	7	5
113	Improved Procurement of Resources	105	4.333	6	6	4	0	6	5	1	6	5
128	Increased Organizational Commitment	105	4.333	5	5	4	1	6	4	1	7	6

Table 24: Expert Evaluation of Benefits from Literature

No.	Benefit Identified in Literature	Rank	Avg.	Expert No. 1	2	3	4	5	6	7	8	9
139	Improved Organizational Effectiveness	105	4.333	5	5	4	1	6	5	1	6	6
157	Formal Establishment, or Improvement of Established Organizational Priorities	105	4.333	4	6	3	4	4	5	1	6	6
165	Improved Project Accounting	105	4.333	3	4	4	3	5	5	3	7	5
15	Improved Self-Actualization	112	4.222	4	5	2	5	6	4	3	4	5
51	Reduced Number of Trainee Mistakes	112	4.222	5	5	5	2	5	7	3	0	6
60	Improved Documentation Management	112	4.222	3	4	5	1	5	6	2	7	5
91	Improved Financial Performance	112	4.222	3	5	2	0	6	5	4	7	6
101	Improved Quality Management	112	4.222	4	6	4	2	4	5	1	6	6
108	Positive Professional Development of Employees toward Career Advancement	112	4.222	6	5	3	2	6	6	4	0	6
152	Improved Organizational Capacity for Work.	112	4.222	4	6	4	5	6	6	1	0	6
16	Improved Self-Efficacy	119	4.111	5	5	2	6	6	4	3	6	0
32	Improved Cost Performance	119	4.111	2	5	5	3	4	5	1	7	5
44	Expanded Participant Job Performance Capabilities	119	4.111	5	5	5	2	6	5	1	4	4
49	Improved Job Behavior and Productive Employee Conduct	119	4.111	4	5	4	2	5	5	1	6	5
67	Improved Problem Solving	119	4.111	5	4	4	2	5	4	1	6	6
120	Reduced Project, Program, and Portfolio Risk	119	4.111	5	6	5	1	5	2	1	6	6
122	Improved Customer Relations and Customer Satisfaction	119	4.111	4	6	2	1	6	5	1	6	6
131	Improved Engagement of Stakeholders	119	4.111	4	4	4	1	5	6	1	6	6
137	Continuous Improvement within the Organization	119	4.111	5	4	4	1	4	6	1	6	6
138	Improved Dialog within the Organization	119	4.111	5	4	4	1	6	4	1	6	6
12	Improved Morale	129	4.000	4	4	4	6	6	5	3	0	4
38	Reduced Cost Performance Index (CPI) Variances	129	4.000	2	4	5	4	5	5	1	5	5
50	Improved Trainee Job Performance	129	4.000	5	5	5	2	5	5	3	0	6
63	Increased Innovation in Training Participants	129	4.000	4	4	4	5	4	5	1	4	5
66	Incorporation of Lessons Learned from Past Experience into Current and Future Projects, Programs, and Portfolios	129	4.000	3	4	4	2	6	4	1	6	6
102	Improved Quality of Work in Individuals	129	4.000	4	6	4	2	4	5	1	5	5
110	Improved Management of Human Resources	129	4.000	3	5	2	2	5	6	1	6	6
132	Improved Stakeholder Management	129	4.000	5	4	2	1	5	6	1	6	6
21	Improved Conflict Management	137	3.889	4	5	2	2	5	5	1	5	6
31	Reduced Cost Overruns	137	3.889	2	4	5	3	4	4	1	7	5
78	Improved Organizational Reputation	137	3.889	4	4	2	1	6	6	1	6	5
130	Positive Reaction to Training in	140	3.778	5	4	5	5	0	5	4	0	6

Table 24: Expert Evaluation of Benefits from Literature

No.	Benefit Identified in Literature	Rank	Avg.	Expert No. 1	2	3	4	5	6	7	8	9
	Participants											
144	Improved or Strengthened Leadership	140	3.778	5	6	3	1	5	4	4	0	6
158	Improvement in Organizational Strategy	140	3.778	4	0	2	4	6	5	1	6	6
166	Improved Project Accounting Practices	140	3.778	3	4	2	3	3	5	1	7	6
40	Improved Ability to Model Revenue and Cash Flow	144	3.667	2	3	4	2	4	6	1	6	5
112	Improved Materials Management	144	3.667	4	0	5	0	6	6	1	6	5
77	Improved Identification of Business Opportunities	146	3.556	3	5	2	1	6	4	1	6	4
127	Improved Satisfaction of Management	146	3.556	5	5	4	1	6	5	1	0	5
75	Increased Market Share	148	3.444	3	4	2	1	4	6	1	5	5
124	Increased Employee Satisfaction	148	3.444	5	4	2	1	6	4	3	0	6
169	Improved Quality of Life	148	3.444	4	6	2	1	5	5	1	0	7
74	Expansion of Customer Base	151	3.333	3	4	2	1	5	4	1	5	5
76	Development of New Markets for Products and Services	151	3.333	3	4	2	1	6	4	1	4	5
123	Improved Customer Service	151	3.333	4	6	2	1	5	5	1	0	6
129	Improved Owner/Shareholder Satisfaction	151	3.333	4	5	4	1	6	4	1	0	5
155	Formal Establishment, or Improvement of Established Organizational Mission	151	3.333	4	6	4	4	3	3	1	0	5
28	Improved Speed of Cash Flow	156	3.222	2	4	2	1	6	4	3	7	0
106	Increased Revenue	156	3.222	3	0	2	2	4	5	1	6	6
133	Value Created for Subcontractors/Suppliers	156	3.222	5	4	2	0	4	6	1	0	7
153	Positive Organizational Change	156	3.222	5	0	2	4	5	5	3	0	5
159	Positive Organizational Transformation	156	3.222	5	0	2	4	6	5	1	0	6
79	Improved Organizational Visibility within the Market	161	3.111	4	0	2	1	5	4	1	6	5
81	Improved Sales	161	3.111	3	0	2	1	5	5	1	6	5
126	Improved Stewardship of Customer Funds	161	3.111	5	4	4	1	5	3	1	0	5
148	Elimination of Unnecessary Meetings	161	3.111	4	2	2	1	6	5	1	0	7
55	Improved Subjective Job Performance	165	2.889	4	5	5	0	0	6	1	0	5
141	Improved Ability to Successfully Manage Organizational Change (i.e. Growth)	165	2.889	4	0	3	1	6	5	1	0	6
9	Improved Cross Cultural Adjustment	167	2.778	4	4	0	4	3	4	1	0	5
125	Reduced Employee Turnover	168	2.667	4	0	2	1	6	5	1	0	5
118	Return of Allocated, but Unused Funding to the Performing Organization	169	2.556	5	0	4	0	3	4	1	0	6
5	Decreased Absenteeism	170	2.111	2	0	2	1	6	3	1	0	4
163	Development of New Products	171	2.000	4	0	2	1	3	3	1	0	4
54	Increased Revenue Per Employee	172	1.889	2	5	0	0	0	7	3	0	0

Organizations Contacted in Industry Outreach

The following industry and practitioner organizations were approached with regard to this research:

Table 25: Industry/Practitioner Organizations Contacted in Industry Outreach

No.	User Group/Conference/Organization
1	AACE International - The Authority for Total Cost Management
2	Agile Alliance
3	AllPM
4	American Association of State Highway and Transportation Officials
5	American Institute of Architects (AIA)
6	American Institute of Steel Construction (AISC)
7	American Management Association
8	American Road & Transportation Builders Association (ARTBA)
9	American Society for the Advancement of Project Management
10	American Society of Concrete Contractors
11	American Society of Mechanical Engineers
12	American Society of Mechanical Engineers
13	American Society of Professional Estimators (ASPE)
14	American Subcontractors Association, Inc.
15	Asia Pacific Federation of Project Management
16	Asociacion Espanola de Ingenieria de Proyectos (AEIPRO)
17	Associated Builders and Contractors
18	Associated General Contractors of America (AGC)
19	Association for Project Management (UK)
20	Atlantic Global
21	AtTask
22	Augeo Software
23	Australian Institute of Project Management
24	Autodesk
25	Automation Centre
26	BMC Software
27	BPubs.com
28	CA Technologies
29	Cardinis Solutions
30	Celoxis
31	Center for Transportation Research (CTR) at The University of Texas at Austin
32	Clarizen
33	cnbr-l@yahoogroups.com

Table 25: Industry/Practitioner Organizations Contacted in Industry Outreach

No.	User Group/Conference/Organization
34	Compuware
35	Construction Estimating Institute
36	Construction Financial Management Association (CFMA)
37	Construction Management Association of America (CMAA)
38	Construction Owners Association of America (COAA)
39	Danish Project Management Association
40	Daptiv
41	Deltek
42	Engineering Advancement Association of Japan
43	gantthead.com
44	GAPPS - Global Alliance for Project Performance Standards
45	Genius Inside
46	IIBA
47	Institute of Heating and Air Conditioning Industries, Inc.
48	International Association for Project and Program Management (IAPPM)
49	International Petroleum Technology Institute
50	Intuit
51	IPMA
52	lnnotas
53	Major Projects Association
54	Mechanical Contractors Association of America
55	Microsoft Project / PMIS
56	Microsoft Project User Group (MPUG)
57	National Electrical Contractors Association
58	National Precast Concrete Association
59	National Ready Mix Concrete Association
60	National Roofing Contractors Association
61	National Utility Contractors Association
62	Onepoint Software
63	Oracle Primavera
64	Planisware
65	Planview
66	planningplanet.com
67	PM World Today
68	PMI
69	PMI Asia Pacific
70	PMI China
71	PMI India
72	Project lnVision
73	Project Objects

Table 25: Industry/Practitioner Organizations Contacted in Industry Outreach

No.	User Group/Conference/Organization
74	Project. net
75	projectsatwork.com
76	SAP
77	Sciforma
78	Semantic Space Technologies
79	Software Engineering Institute (SEI)
80	Stowarzyszenie Project Management Polska
81	Swedish Project Management Society
82	Swiss Project Management Association
83	Tenrox
84	VCSonline

Industry Survey Statistics

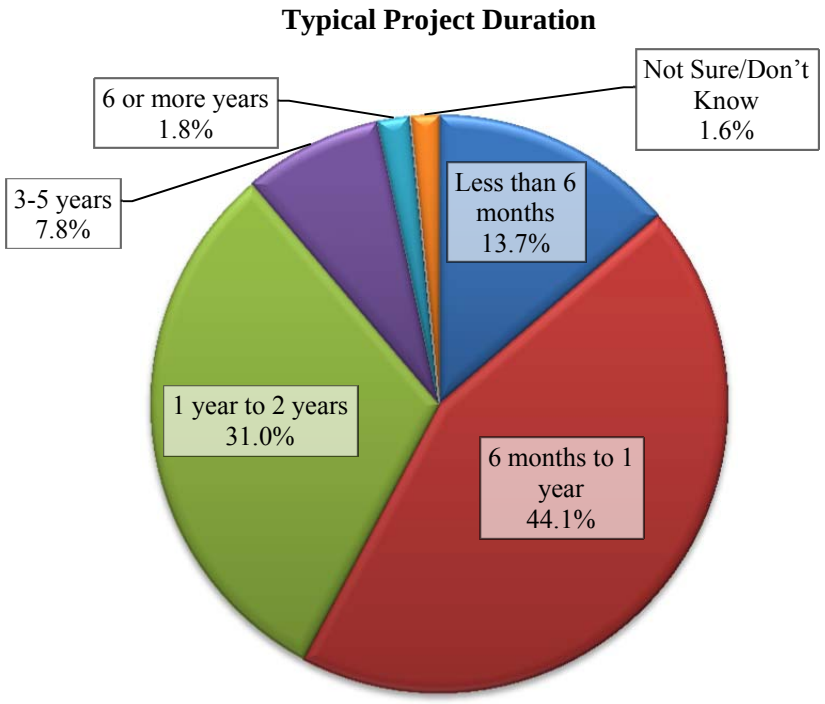


Figure 9: Typical Project Duration

Table 26: Typical Duration of Projects

No.	Characteristic	Frequency	Percent
	Typical Project Duration		
1	Less than 6 months	140	13.7
2	6 months to 1 year	450	44.1
3	1 year to 2 years	317	31.0
4	3-5 years	80	7.8
5	6 or more years	18	1.8
6	Not Sure/Don't Know	16	1.6
	Total	1021	100.0

How Long Has Org. Unit Used PM Software?

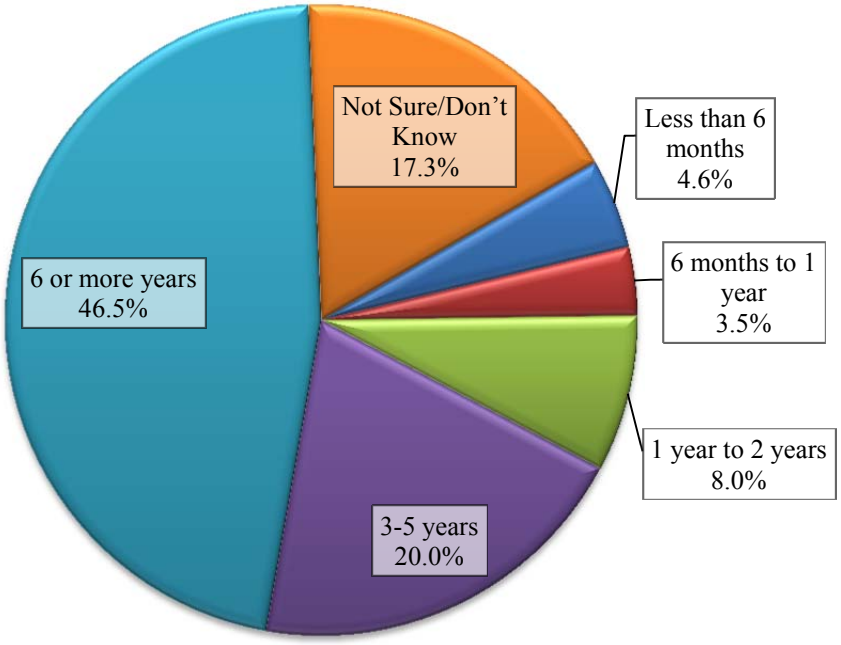


Figure 10: How Long Has Org. Unit Used PM Software?

Table 27: History of PM Software Usage

No.	Characteristic	Frequency	Percent
	How Long Has Org. Used PM Software?		
1	Less than 6 months	47	4.6
2	6 months to 1 year	36	3.5
3	1 year to 2 years	82	8.0
4	3-5 years	204	20.0
5	6 or more years	475	46.5
6	Not Sure/Don't Know	177	17.3
	Total	1021	100.0

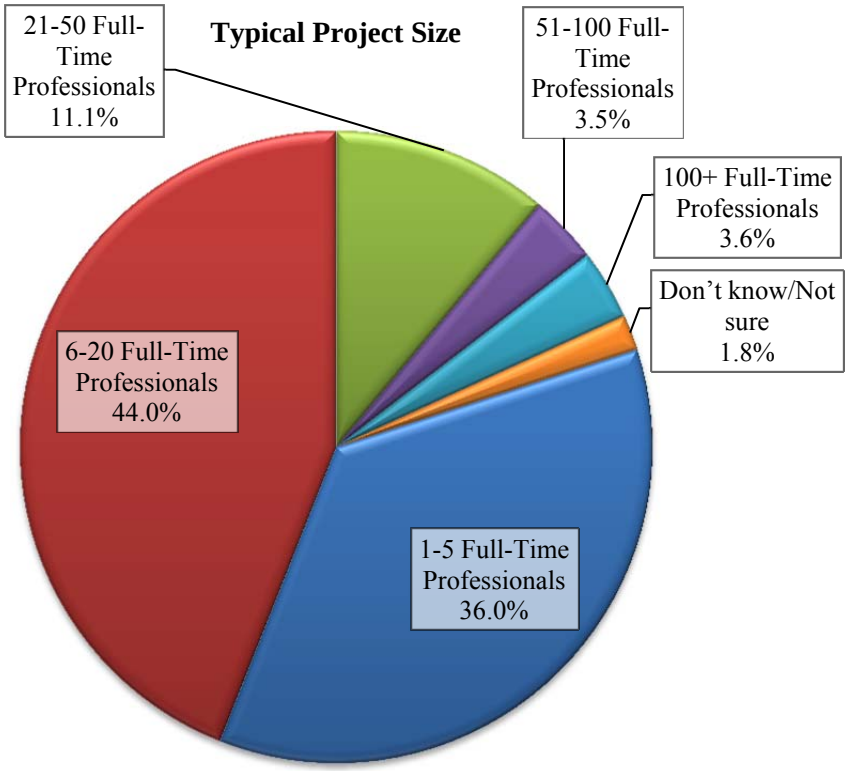


Figure 11: Typical Project Size

Table 28: Typical Size of Projects

No.	Characteristic	Frequency	Percent
	Typical Project Size		
1	1-5 Full-Time Professionals	368	36
2	6-20 Full-Time Professionals	449	44
3	21-50 Full-Time Professionals	113	11.1
4	51-100 Full-Time Professionals	36	3.5
5	100+ Full-Time Professionals	37	3.6
6	Don't know/Not sure	18	1.8
	Total	1021	100.0

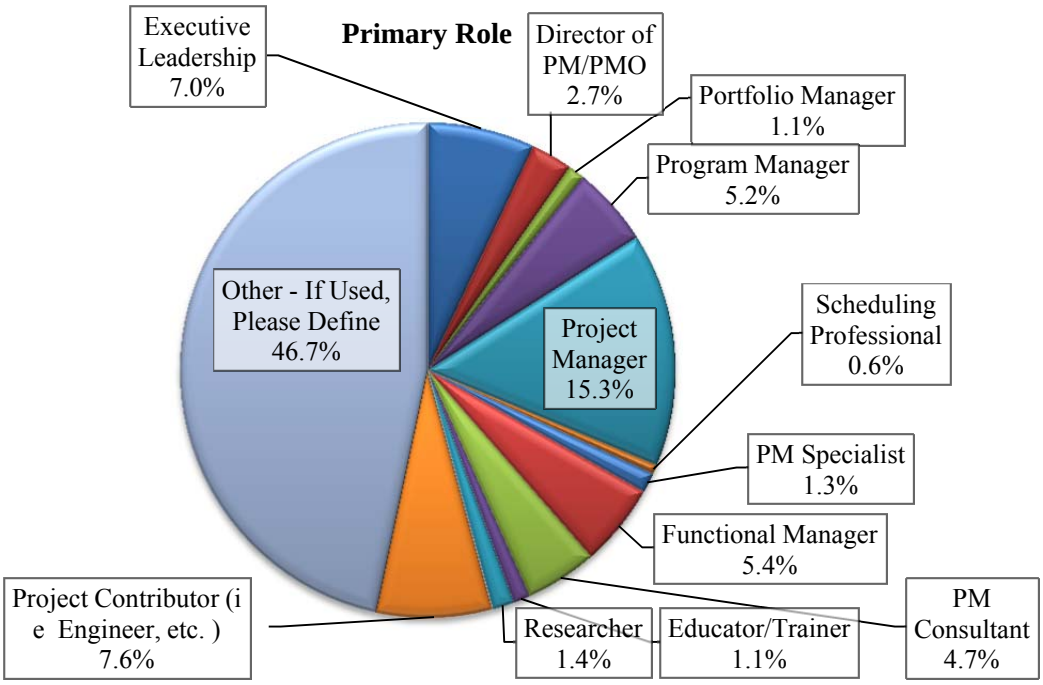


Figure 12: Primary Role of Respondents

Table 29: Role of Industry Survey Respondents

No.	Characteristic	Frequency	Percent
	Primary Role		
1	Executive Leadership	71	7.0
2	Director of PM/PMO	28	2.7
3	Portfolio Manager	11	1.1
4	Program Manager	53	5.2
5	Project Manager	156	15.3
6	Scheduling Professional	6	.6
7	PM Specialist	13	1.3
8	Functional Manager	55	5.4
9	PM Consultant	48	4.7
10	Educator/Trainer	11	1.1
11	Researcher	14	1.4
12	Project Contributor (i e Engineer, etc.)	78	7.6
13	Other - If Used, Please Define	477	46.7
	Total	1021	100.0

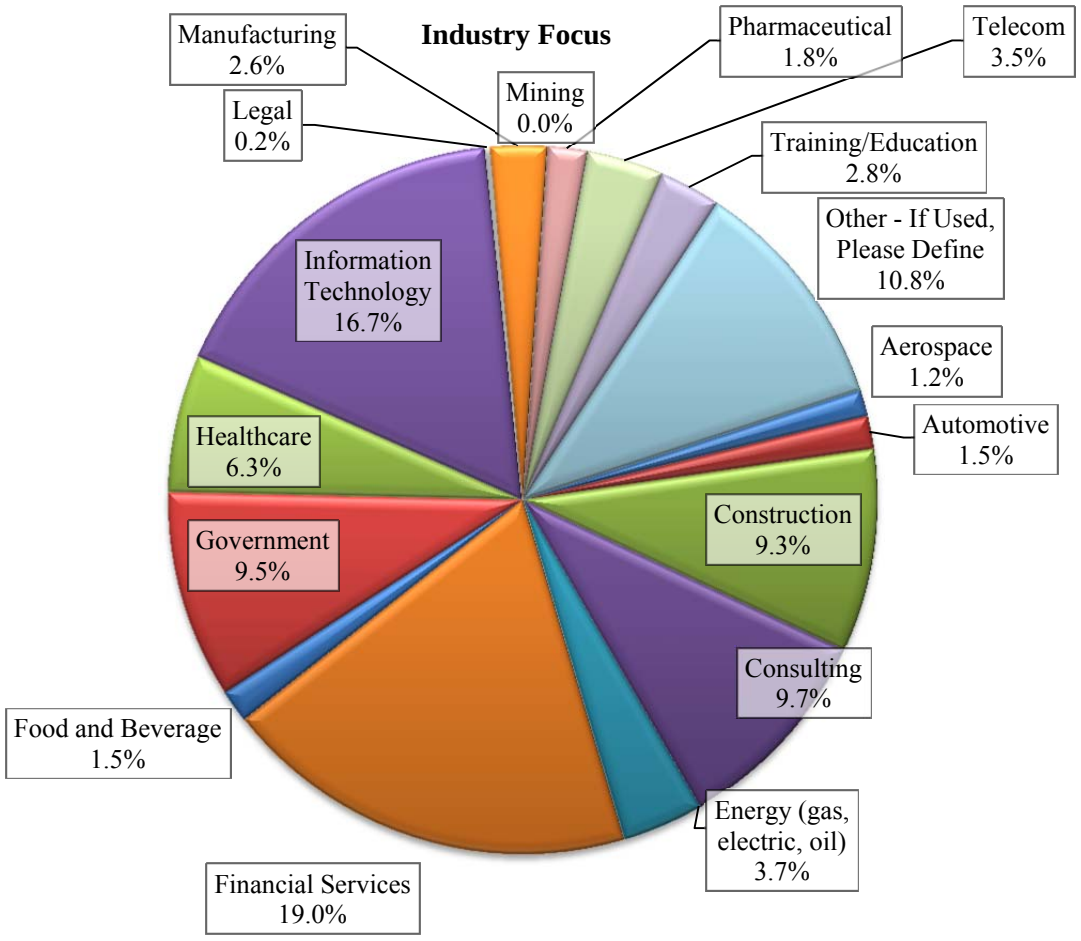


Figure 13: Industry Focus

Table 30: Primary Industry Focus

No.	Characteristic	Frequency	Percent
	Industry Focus		
1	Aerospace	12	1.2
2	Automotive	15	1.5
3	Construction	95	9.3
4	Consulting	99	9.7
5	Energy (gas, electric, oil)	38	3.7
6	Financial Services	194	19

Table 30: Primary Industry Focus

No.	Characteristic	Frequency	Percent
7	Food and Beverage	15	1.5
8	Government	97	9.5
9	Healthcare	64	6.3
10	Information Technology	170	16.7
11	Legal	2	0.2
12	Manufacturing	27	2.6
13	Mining	0	0
14	Pharmaceutical	18	1.8
15	Telecom	36	3.5
16	Training/Education	29	2.8
17	Other - If Used, Please Define	110	10.8
	Total	1021	100

Typical Project Complexity

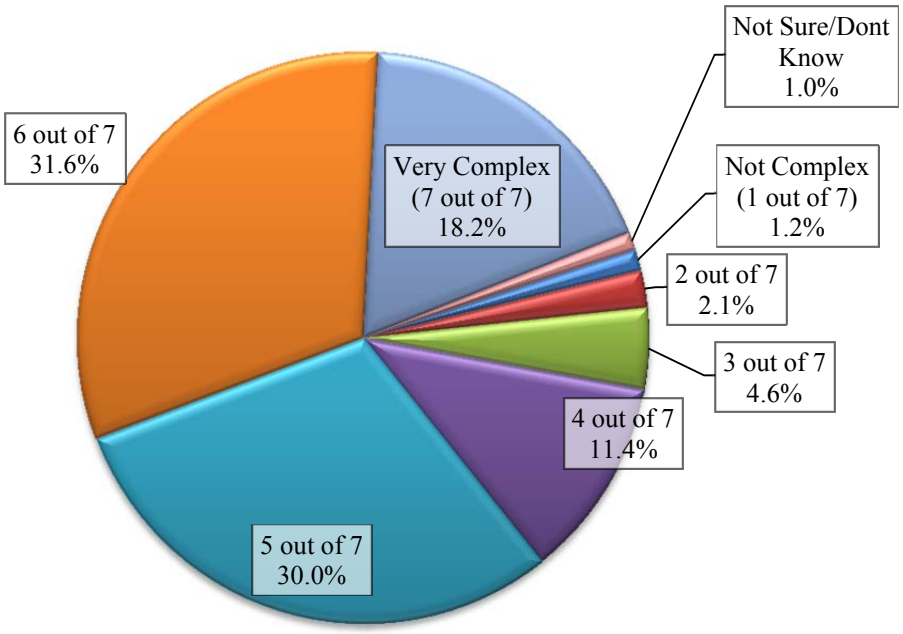


Figure 14: Typical Project Complexity

Table 31: Project Complexity

No.	Characteristic	Frequency	Percent
	Typical Project Complexity		
1	Not Complex (1)	12	1.2
2	2	21	2.1
3	3	47	4.6
4	4	116	11.4
5	5	306	30.0
6	6	323	31.6
7	Very Complex (7)	186	18.2
8	Not Sure/Don't Know	10	1.0
	Total	1021	100.0

Number of Projects Managed Simultaneously

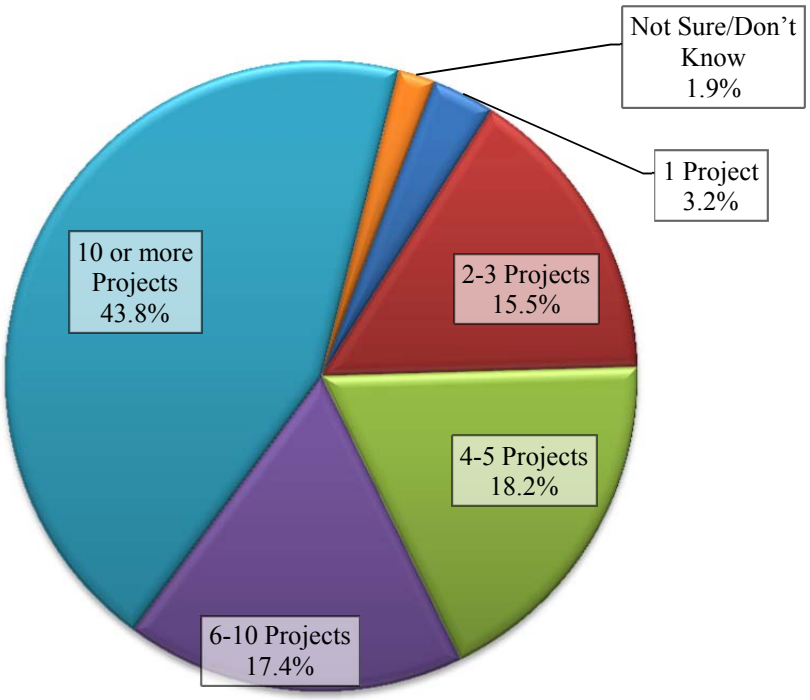


Figure 15: Number of Projects Managed Simultaneously

Table 32: Concurrent Projects

No.	Characteristic	Frequency	Percent
	Number of Projects Managed Simultaneously		
1	1 Project	33	3.2
2	2-3 Projects	158	15.5
3	4-5 Projects	186	18.2
4	6-10 Projects	178	17.4
5	10 or more Projects	447	43.8
6	Not Sure/Don't Know	19	1.9
	Total	1021	100.0

Supporting Calculations

rvNumberofYearsofExperiePM

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	43	4.2	4.2	4.2
	1	24	2.3	2.4	6.6
	2	41	4.0	4.0	10.6
	3	42	4.1	4.1	14.7
	4	52	5.1	5.1	19.8
	5	76	7.4	7.4	27.2
	6	60	5.9	5.9	33.1
	7	54	5.3	5.3	38.4
	8	38	3.7	3.7	42.1
	9	15	1.5	1.5	43.6
	10	120	11.7	11.8	55.3
	11	16	1.6	1.6	56.9
	12	48	4.7	4.7	61.6
	13	19	1.9	1.9	63.5
	14	26	2.5	2.5	66.0
	15	81	7.9	7.9	73.9
	16	12	1.2	1.2	75.1
	17	10	1.0	1.0	76.1
	18	13	1.3	1.3	77.4
	19	6	.6	.6	78.0
	20	61	6.0	6.0	83.9
	21	6	.6	.6	84.5
	22	13	1.3	1.3	85.8
	23	8	.8	.8	86.6
	24	5	.5	.5	87.1
	25	36	3.5	3.5	90.6
	26	4	.4	.4	91.0

	27	6	.6	.6	91.6
	28	6	.6	.6	92.2
	29	4	.4	.4	92.6
	30	29	2.8	2.8	95.4
	31	1	.1	.1	95.5
	32	6	.6	.6	96.1
	33	3	.3	.3	96.4
	34	2	.2	.2	96.6
	35	4	.4	.4	97.0
	36	2	.2	.2	97.2
	37	2	.2	.2	97.4
	38	4	.4	.4	97.7
	39	2	.2	.2	97.9
	40	21	2.1	2.1	100.0
	Total	1021	99.9	100.0	
Missing	System	1	.1		
Total		1022	100.0		

rvTypicalProjectDuration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	140	13.7	13.7	13.7
	2	450	44.0	44.1	57.8
	3	317	31.0	31.0	88.8
	4	80	7.8	7.8	96.7
	5	18	1.8	1.8	98.4
	6	16	1.6	1.6	100.0
	Total	1021	99.9	100.0	
Missing	System	1	.1		
Total		1022	100.0		

rvTypicalProjectSize

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	18	1.8	1.8	1.8
	1	368	36.0	36.0	37.8
	2	449	43.9	44.0	81.8
	3	113	11.1	11.1	92.9
	4	36	3.5	3.5	96.4
	5	37	3.6	3.6	100.0
	Total	1021	99.9	100.0	
Missing	System	1	.1		
Total		1022	100.0		

rvProjectComplexity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	257	25.1	30.8	30.8
	2	443	43.3	53.1	83.8
	3	55	5.4	6.6	90.4
	4	8	.8	1.0	91.4
	5	23	2.3	2.8	94.1
	6	36	3.5	4.3	98.4
	7	13	1.3	1.6	100.0
	Total	835	81.7	100.0	
Missing	System	187	18.3		
Total		1022	100.0		

rvPrimaryRole

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	71	6.9	7.0	7.0
	2	28	2.7	2.7	9.7
	3	11	1.1	1.1	10.8
	4	53	5.2	5.2	16.0
	5	156	15.3	15.3	31.2
	6	6	.6	.6	31.8
	7	13	1.3	1.3	33.1
	8	55	5.4	5.4	38.5
	9	48	4.7	4.7	43.2
	10	11	1.1	1.1	44.3
	11	14	1.4	1.4	45.6
	12	78	7.6	7.6	53.3
	13	477	46.7	46.7	100.0
	Total	1021	99.9	100.0	
Missing	System	1	.1		
Total		1022	100.0		

rvIndustryFocus

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	12	1.2	1.2	1.2
	2	15	1.5	1.5	2.6
	3	95	9.3	9.3	11.9
	4	99	9.7	9.7	21.6
	5	38	3.7	3.7	25.4
	6	194	19.0	19.0	44.4
	7	15	1.5	1.5	45.8
	8	97	9.5	9.5	55.3

	9	64	6.3	6.3	61.6
	10	170	16.6	16.7	78.3
	11	2	.2	.2	78.5
	12	27	2.6	2.6	81.1
	14	18	1.8	1.8	82.9
	15	36	3.5	3.5	86.4
	16	139	13.6	13.6	100.0
	Total	1021	99.9	100.0	
Missing	System	1	.1		
Total		1022	100.0		

rvTotalHours

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	425	41.6	41.6	41.6
	2	22	2.2	2.2	43.8
	4	34	3.3	3.3	47.1
	6	22	2.2	2.2	49.3
	8	31	3.0	3.0	52.3
	10	18	1.8	1.8	54.1
	12	30	2.9	2.9	57.0
	14	9	.9	.9	57.9
	16	29	2.8	2.8	60.7
	18	7	.7	.7	61.4
	20	15	1.5	1.5	62.9
	22	9	.9	.9	63.8
	24	18	1.8	1.8	65.5
	26	2	.2	.2	65.7
	28	8	.8	.8	66.5
	30	5	.5	.5	67.0
	32	25	2.4	2.4	69.4

	36	8	.8	.8	70.2
	38	3	.3	.3	70.5
	40	23	2.3	2.3	72.8
	42	3	.3	.3	73.1
	44	7	.7	.7	73.8
	46	1	.1	.1	73.8
	48	18	1.8	1.8	75.6
	50	11	1.1	1.1	76.7
	52	7	.7	.7	77.4
	54	2	.2	.2	77.6
	56	8	.8	.8	78.4
	58	2	.2	.2	78.6
	60	14	1.4	1.4	79.9
	62	3	.3	.3	80.2
	64	9	.9	.9	81.1
	66	4	.4	.4	81.5
	68	6	.6	.6	82.1
	70	3	.3	.3	82.4
	72	8	.8	.8	83.2
	74	4	.4	.4	83.5
	76	2	.2	.2	83.7
	78	1	.1	.1	83.8
	80+	165	16.1	16.2	100.0
	Total	1021	99.9	100.0	
Missing	System	1	.1		
Total		1022	100.0		

rvNumberofYearsofExperiePM

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	43	4.2	4.2	4.2
	1	24	2.4	2.4	6.6
	2	41	4.0	4.0	10.6
	3	42	4.1	4.1	14.7
	4	52	5.1	5.1	19.8
	5	76	7.4	7.4	27.2
	6	60	5.9	5.9	33.1
	7	54	5.3	5.3	38.4
	8	38	3.7	3.7	42.1
	9	15	1.5	1.5	43.6
	10	120	11.8	11.8	55.3
	11	16	1.6	1.6	56.9
	12	48	4.7	4.7	61.6
	13	19	1.9	1.9	63.5
	14	26	2.5	2.5	66.0
	15	81	7.9	7.9	73.9
	16	12	1.2	1.2	75.1
	17	10	1.0	1.0	76.1
	18	13	1.3	1.3	77.4
	19	6	.6	.6	78.0
	20	61	6.0	6.0	83.9
	21	6	.6	.6	84.5
	22	13	1.3	1.3	85.8
	23	8	.8	.8	86.6
	24	5	.5	.5	87.1
	25	36	3.5	3.5	90.6
	26	4	.4	.4	91.0
	27	6	.6	.6	91.6
	28	6	.6	.6	92.2

	29	4	.4	.4	92.6
	30	29	2.8	2.8	95.4
	31	1	.1	.1	95.5
	32	6	.6	.6	96.1
	33	3	.3	.3	96.4
	34	2	.2	.2	96.6
	35	4	.4	.4	97.0
	36	2	.2	.2	97.2
	37	2	.2	.2	97.4
	38	4	.4	.4	97.7
	39	2	.2	.2	97.9
	40	21	2.1	2.1	100.0
	Total	1021	100.0	100.0	

rvTypicalProjectDuration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	140	13.7	13.7	13.7
	2	450	44.1	44.1	57.8
	3	317	31.0	31.0	88.8
	4	80	7.8	7.8	96.7
	5	18	1.8	1.8	98.4
	6	16	1.6	1.6	100.0
	Total	1021	100.0	100.0	

rvTypicalProjectSize

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	18	1.8	1.8	1.8
	1	368	36.0	36.0	37.8
	2	449	44.0	44.0	81.8

	3	113	11.1	11.1	92.9
	4	36	3.5	3.5	96.4
	5	37	3.6	3.6	100.0
	Total	1021	100.0	100.0	

rvProjectComplexity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	257	25.2	30.8	30.8
	2	443	43.4	53.1	83.8
	3	55	5.4	6.6	90.4
	4	8	.8	1.0	91.4
	5	23	2.3	2.8	94.1
	6	36	3.5	4.3	98.4
	7	13	1.3	1.6	100.0
	Total	835	81.8	100.0	
Missing	System	186	18.2		
Total		1021	100.0		

rvPrimaryRole

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	71	7.0	7.0	7.0
	2	28	2.7	2.7	9.7
	3	11	1.1	1.1	10.8
	4	53	5.2	5.2	16.0
	5	156	15.3	15.3	31.2
	6	6	.6	.6	31.8
	7	13	1.3	1.3	33.1
	8	55	5.4	5.4	38.5
	9	48	4.7	4.7	43.2

	10	11	1.1	1.1	44.3
	11	14	1.4	1.4	45.6
	12	78	7.6	7.6	53.3
	13	477	46.7	46.7	100.0
	Total	1021	100.0	100.0	

rvIndustryFocus

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	12	1.2	1.2	1.2
	2	15	1.5	1.5	2.6
	3	95	9.3	9.3	11.9
	4	99	9.7	9.7	21.6
	5	38	3.7	3.7	25.4
	6	194	19.0	19.0	44.4
	7	15	1.5	1.5	45.8
	8	97	9.5	9.5	55.3
	9	64	6.3	6.3	61.6
	10	170	16.7	16.7	78.3
	11	2	.2	.2	78.5
	12	27	2.6	2.6	81.1
	14	18	1.8	1.8	82.9
	15	36	3.5	3.5	86.4
	16	139	13.6	13.6	100.0
	Total	1021	100.0	100.0	

rvTotalHours

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	425	41.6	41.6	41.6
	2	22	2.2	2.2	43.8

4	34	3.3	3.3	47.1
6	22	2.2	2.2	49.3
8	31	3.0	3.0	52.3
10	18	1.8	1.8	54.1
12	30	2.9	2.9	57.0
14	9	.9	.9	57.9
16	29	2.8	2.8	60.7
18	7	.7	.7	61.4
20	15	1.5	1.5	62.9
22	9	.9	.9	63.8
24	18	1.8	1.8	65.5
26	2	.2	.2	65.7
28	8	.8	.8	66.5
30	5	.5	.5	67.0
32	25	2.4	2.4	69.4
36	8	.8	.8	70.2
38	3	.3	.3	70.5
40	23	2.3	2.3	72.8
42	3	.3	.3	73.1
44	7	.7	.7	73.8
46	1	.1	.1	73.8
48	18	1.8	1.8	75.6
50	11	1.1	1.1	76.7
52	7	.7	.7	77.4
54	2	.2	.2	77.6
56	8	.8	.8	78.4
58	2	.2	.2	78.6
60	14	1.4	1.4	79.9
62	3	.3	.3	80.2
64	9	.9	.9	81.1
66	4	.4	.4	81.5

68	6	.6	.6	82.1
70	3	.3	.3	82.4
72	8	.8	.8	83.2
74	4	.4	.4	83.5
76	2	.2	.2	83.7
78	1	.1	.1	83.8
80	165	16.2	16.2	100.0
Total	1021	100.0	100.0	

Consumption - Supporting Statistics and Analysis

Levene's Test of Equality of Error Variances[a]

Dependent Variable:HoursPerDeliveryMethod

F	df1	df2	Sig.
12.549	5	1342	.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + DeliveryMethod

Tests of Between-Subjects Effects

Dependent Variable:HoursPerDeliveryMethod

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Hypothesis	256401.924	1	256401.924	80.098	.000
	Error	16222.050	5.068	3201.085[a]		
DeliveryMethod	Hypothesis	17206.334	5	3441.267	12.200	.000
	Error	378547.698	1342	282.077[b]		

a. .924 MS(DeliveryMethod) + .076 MS(Error)

b. MS(Error)

Effectiveness - Supporting Statistics and Analysis

Levene's Test of Equality of Error Variances[a]

Dependent Variable:Impact

F	df1	df2	Sig.
.631	5	1342	.676

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + DeliveryMethod

Tests of Between-Subjects Effects

Dependent Variable:Impact

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Hypothesis	703597.491	1	703597.491	1012.656	.000
	Error	3553.065	5.114	694.804[a]		
DeliveryMethod	Hypothesis	3712.986	5	742.597	7.149	.000
	Error	139394.399	1342	103.871[b]		

Tests of Between-Subjects Effects

Dependent Variable:Impact

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Hypothesis	703597.491	1	703597.491	1012.656	.000
	Error	3553.065	5.114	694.804[a]		
DeliveryMethod	Hypothesis	3712.986	5	742.597	7.149	.000
	Error	139394.399	1342	103.871[b]		

a. .925 MS(DeliveryMethod) + .075 MS(Error)

b. MS(Error)

2. Grand Mean

Dependent Variable:Impact

Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
23.986	.291	23.414	24.558

Efficiency - Supporting Statistics and Analysis

Levene's Test of Equality of Error Variances[a]

Dependent Variable:ImpactPerHour

F	df1	df2	Sig.
5.030	5	1342	.000

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + DeliveryMethod

Tests of Between-Subjects Effects

Dependent Variable:ImpactPerHour

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Hypothesis	30320.094	1	30320.094	168.967	.000
	Error	932.639	5.197	179.443[a]		
DeliveryMethod	Hypothesis	951.186	5	190.237	4.137	.001
	Error	61710.518	1342	45.984[b]		

Tests of Between-Subjects Effects

Dependent Variable:ImpactPerHour

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	Hypothesis	30320.094	1	30320.094	168.967	.000
	Error	932.639	5.197	179.443[a]		
DeliveryMethod	Hypothesis	951.186	5	190.237	4.137	.001
	Error	61710.518	1342	45.984[b]		

a. .925 MS(DeliveryMethod) + .075 MS(Error)

b. MS(Error)

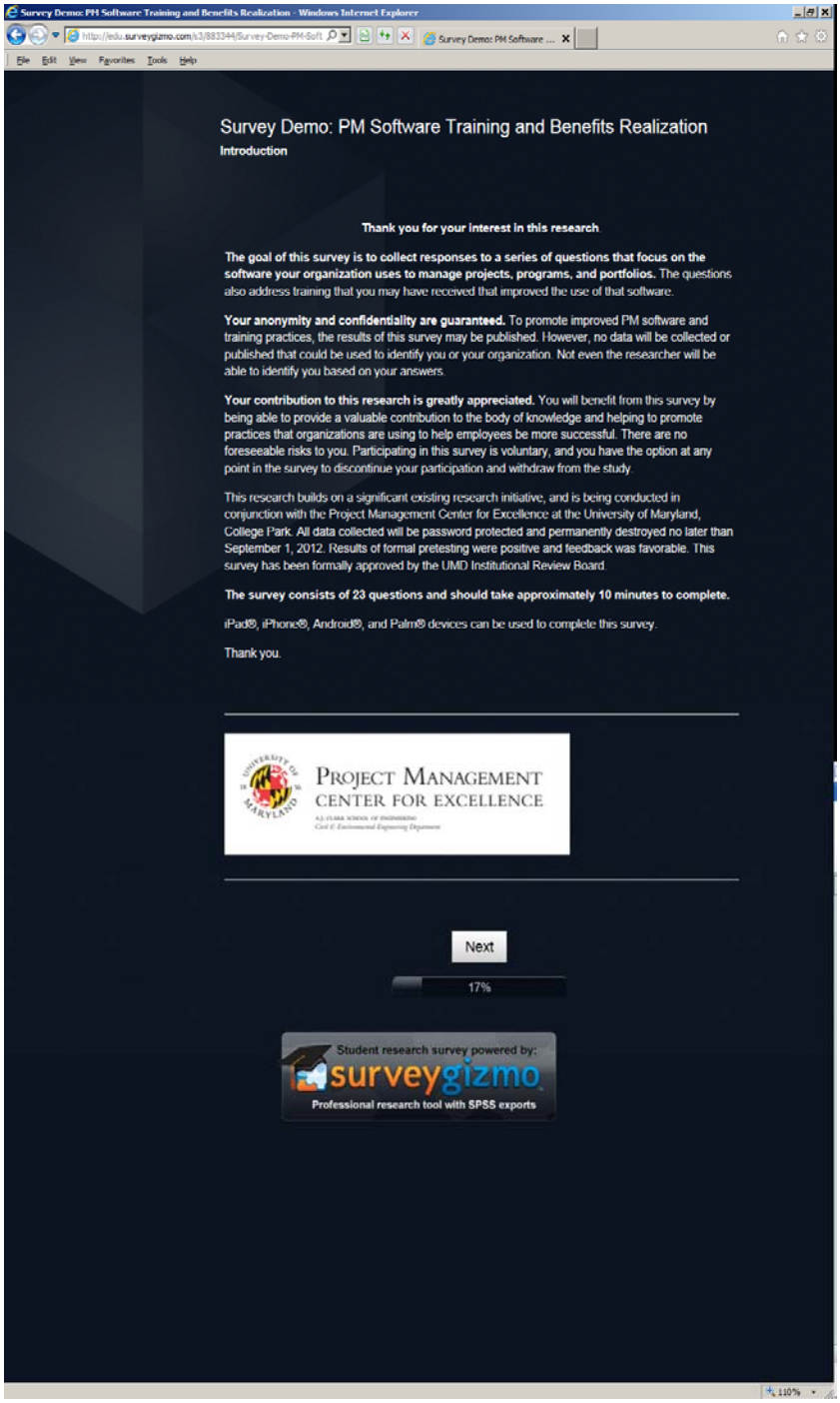
2. Grand Mean

Dependent Variable:ImpactPerHour

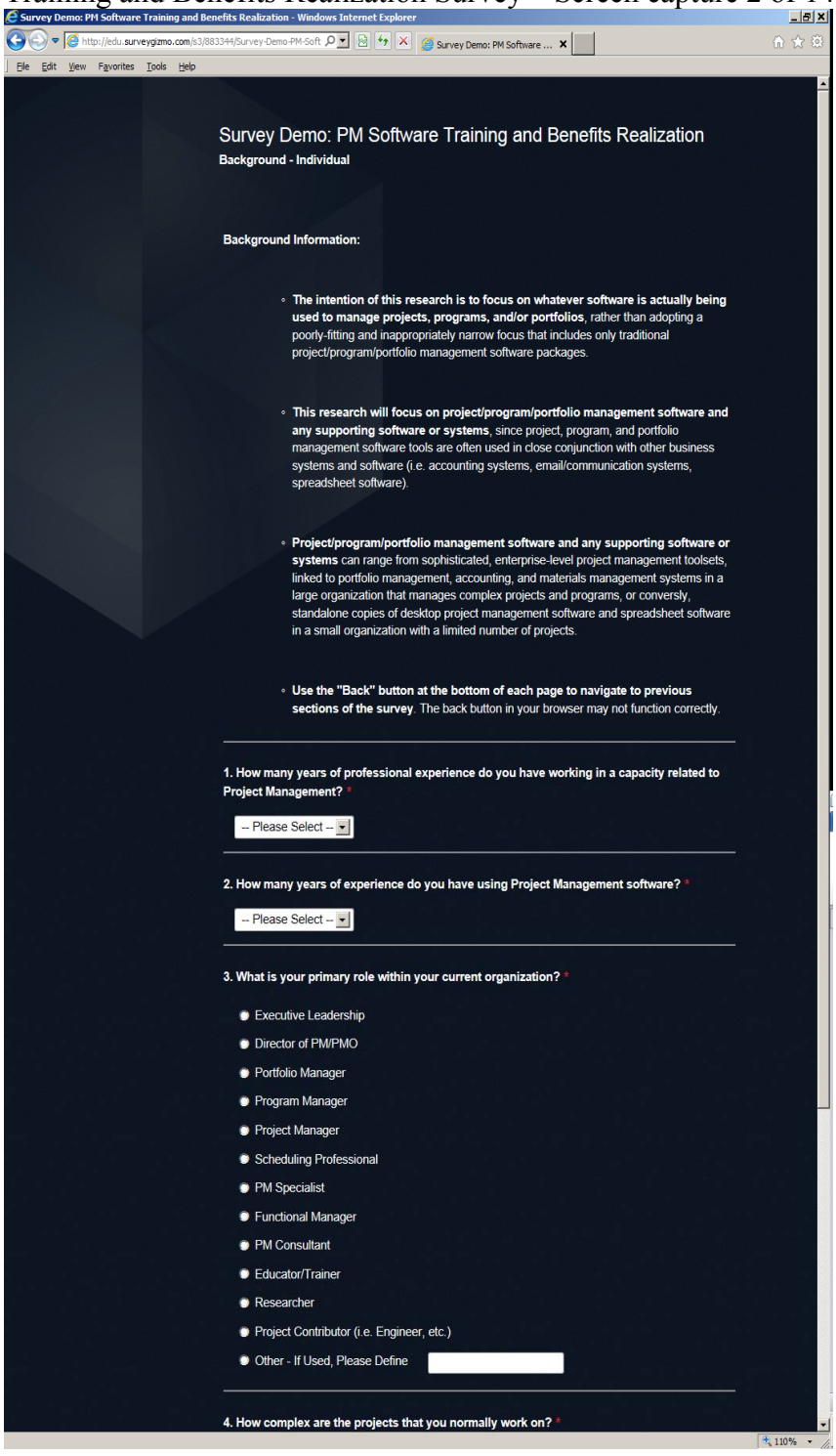
Mean	Std. Error	95% Confidence Interval	
		Lower Bound	Upper Bound
4.979	.194	4.599	5.360

Survey Instrument

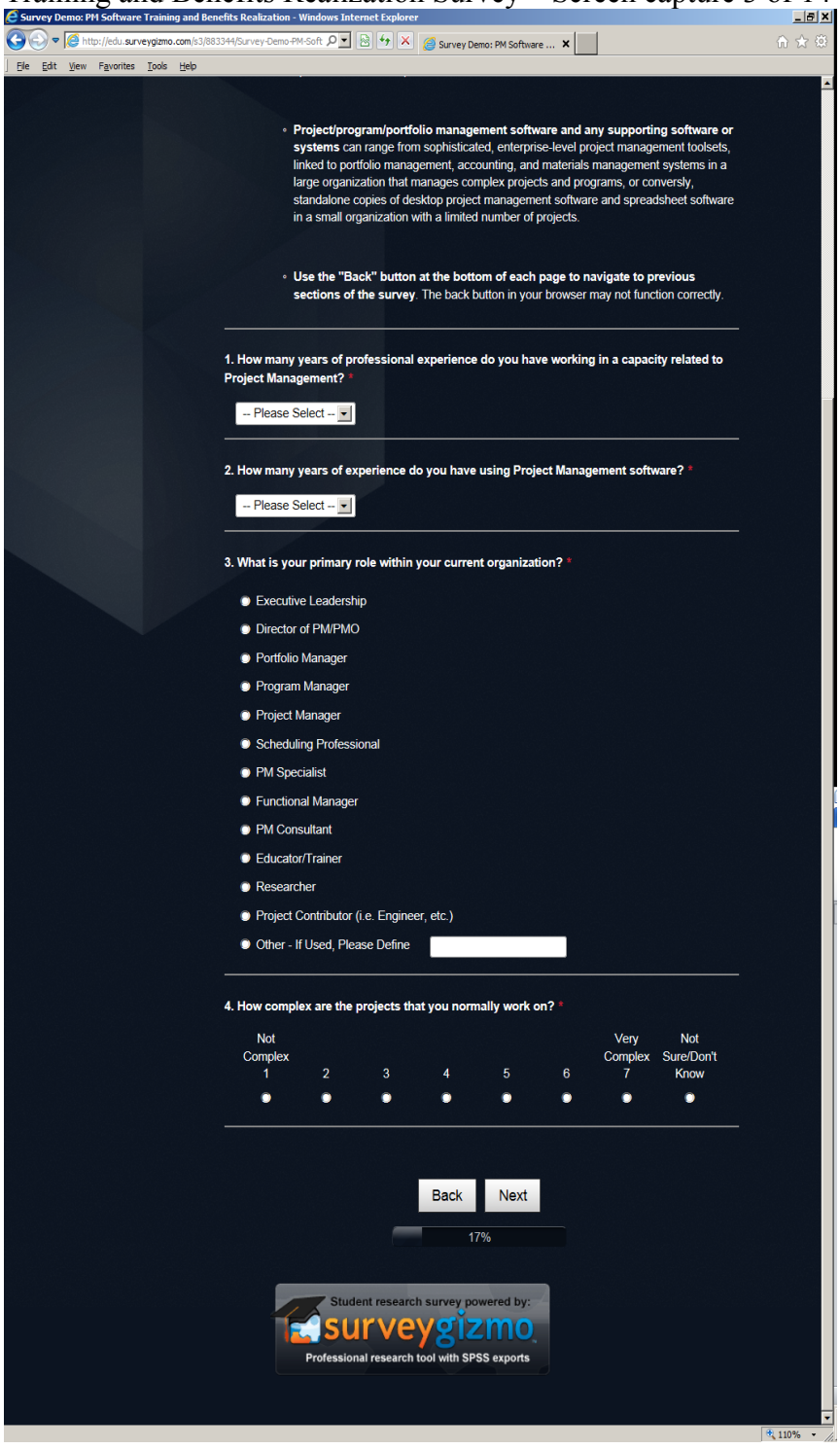
Training and Benefits Realization Survey – Screen capture 1 of 14



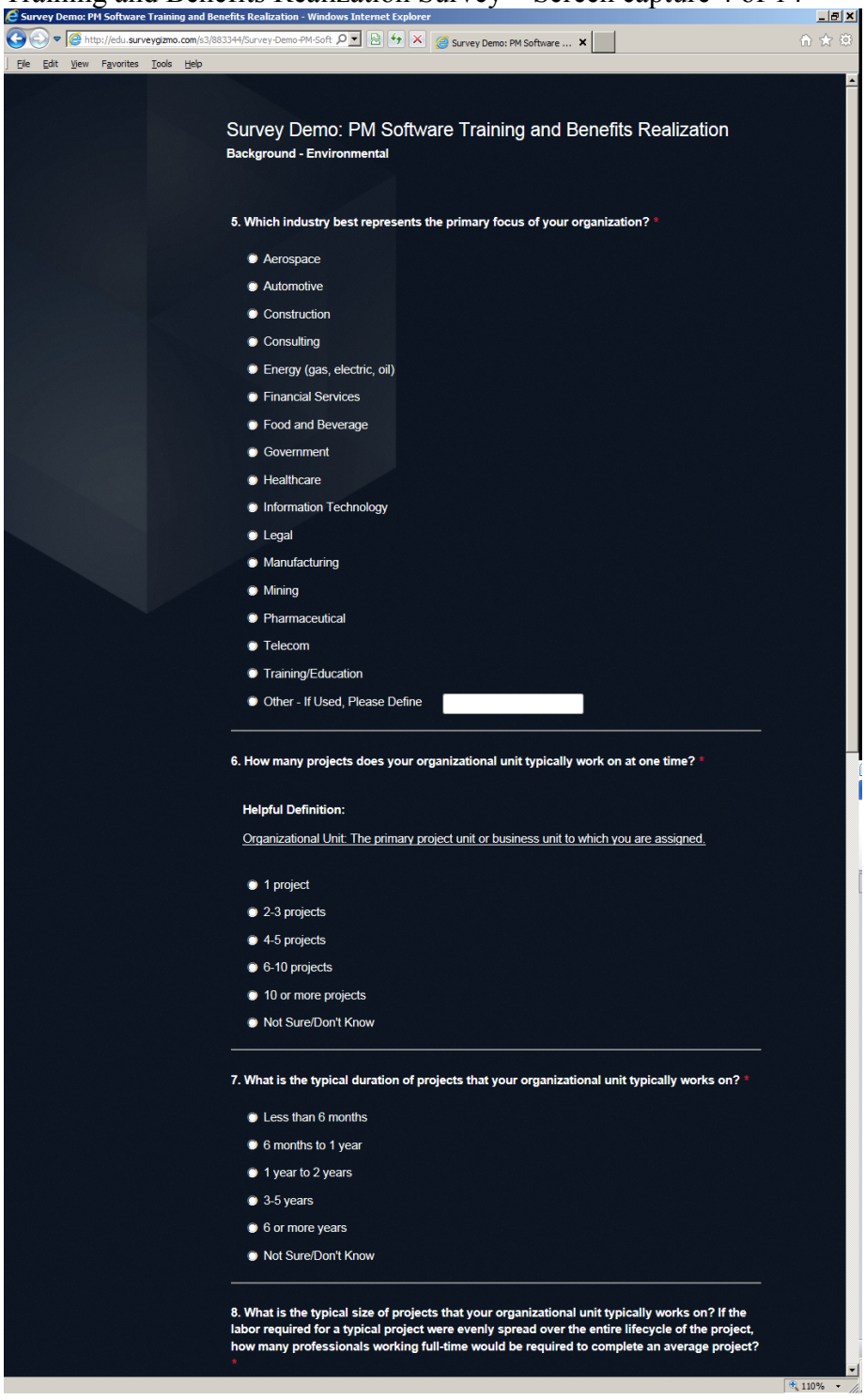
Training and Benefits Realization Survey – Screen capture 2 of 14



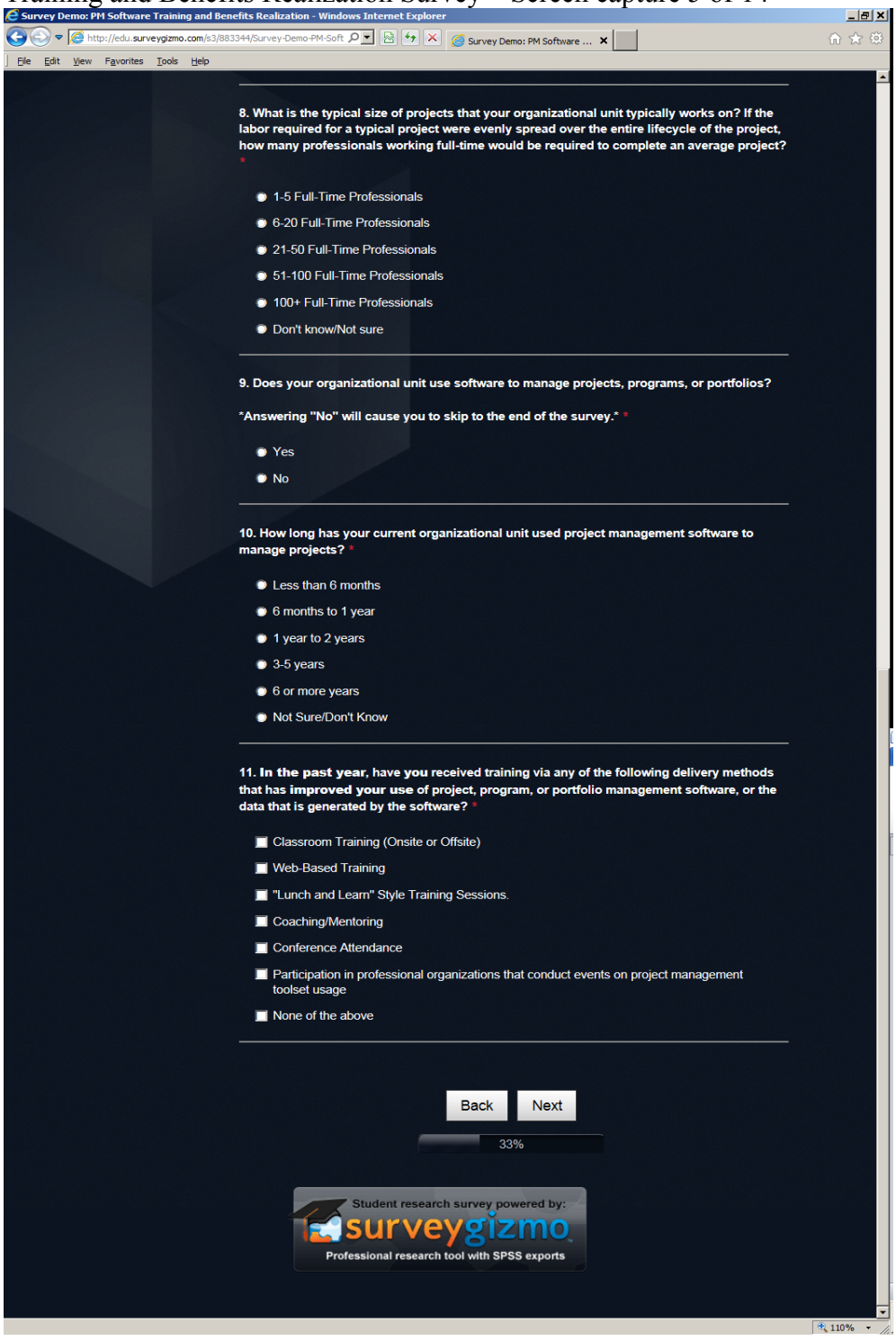
Training and Benefits Realization Survey – Screen capture 3 of 14



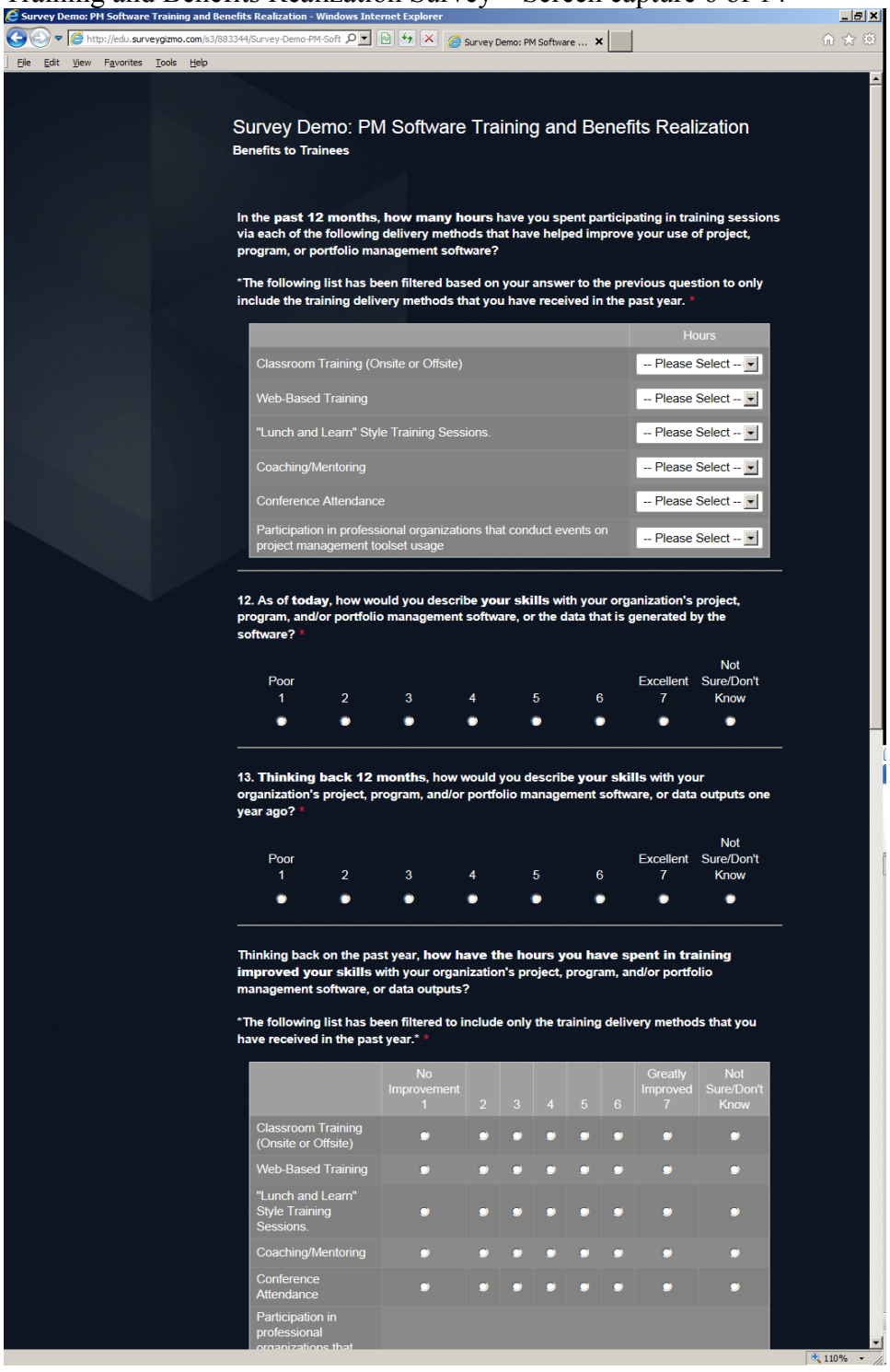
Training and Benefits Realization Survey – Screen capture 4 of 14



Training and Benefits Realization Survey – Screen capture 5 of 14



Training and Benefits Realization Survey – Screen capture 6 of 14



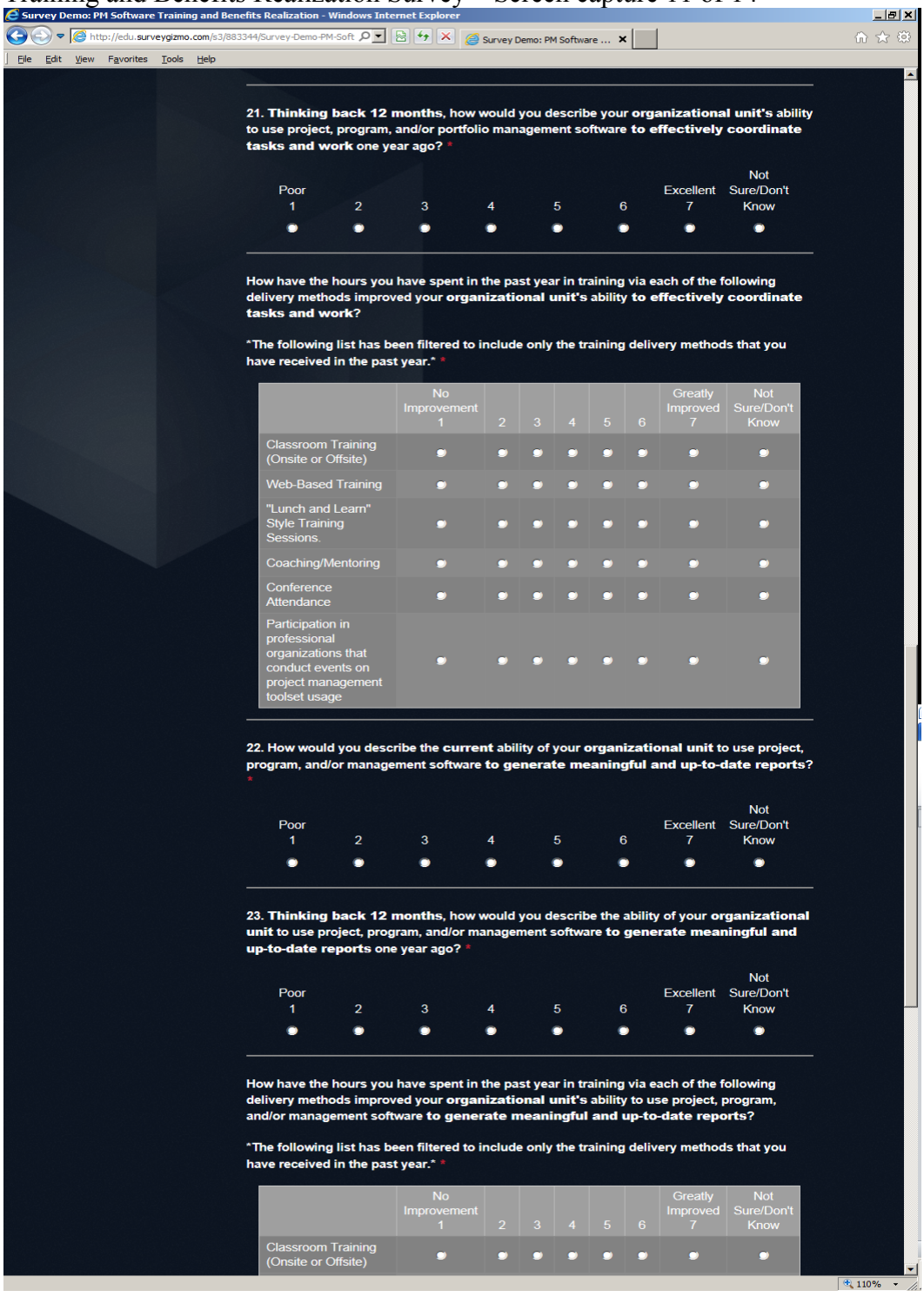
Training and Benefits Realization Survey – Screen capture 7 of 14

Training and Benefits Realization Survey – Screen capture 8 of 14

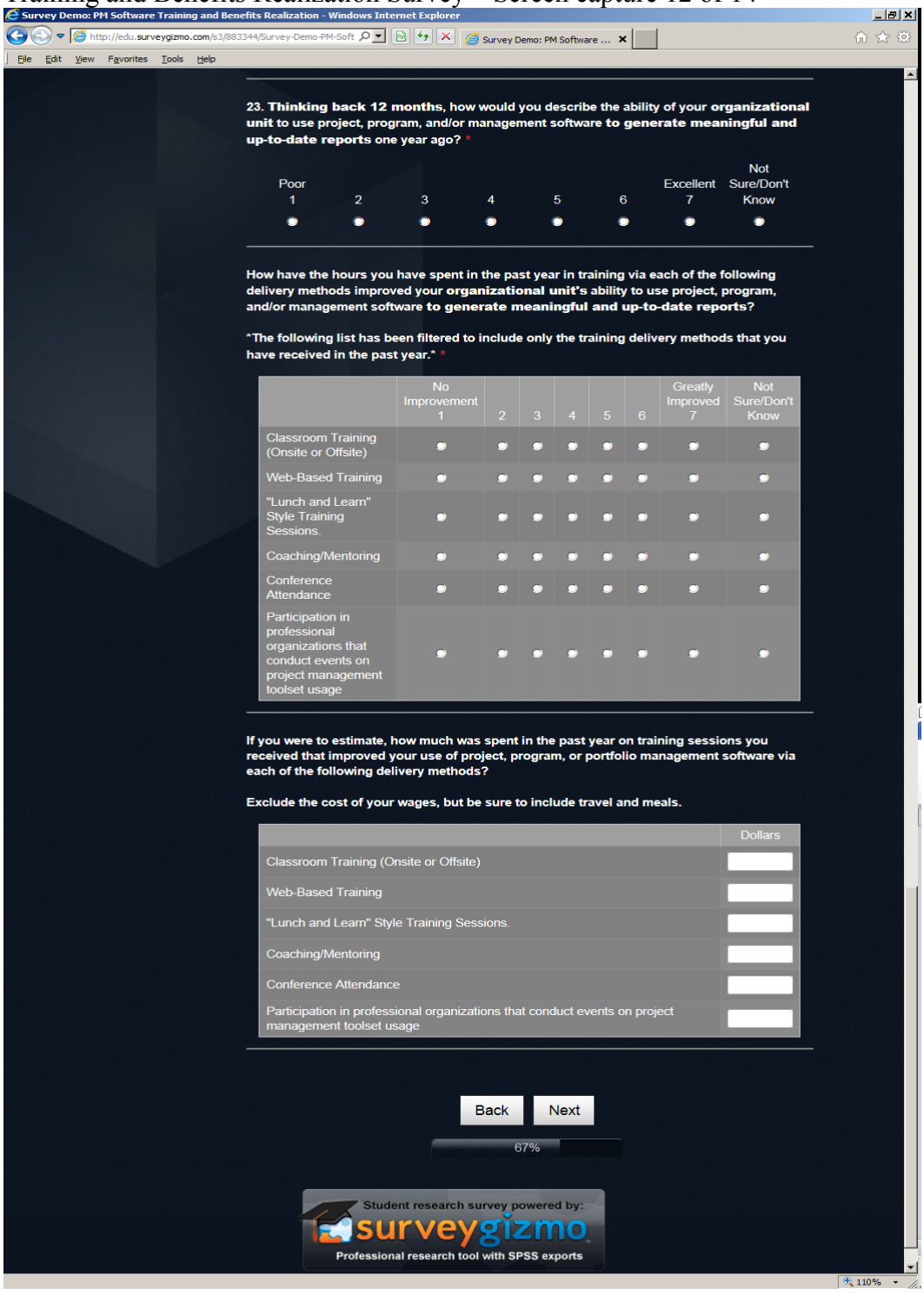
Training and Benefits Realization Survey – Screen capture 9 of 14

Training and Benefits Realization Survey – Screen capture 10 of 14

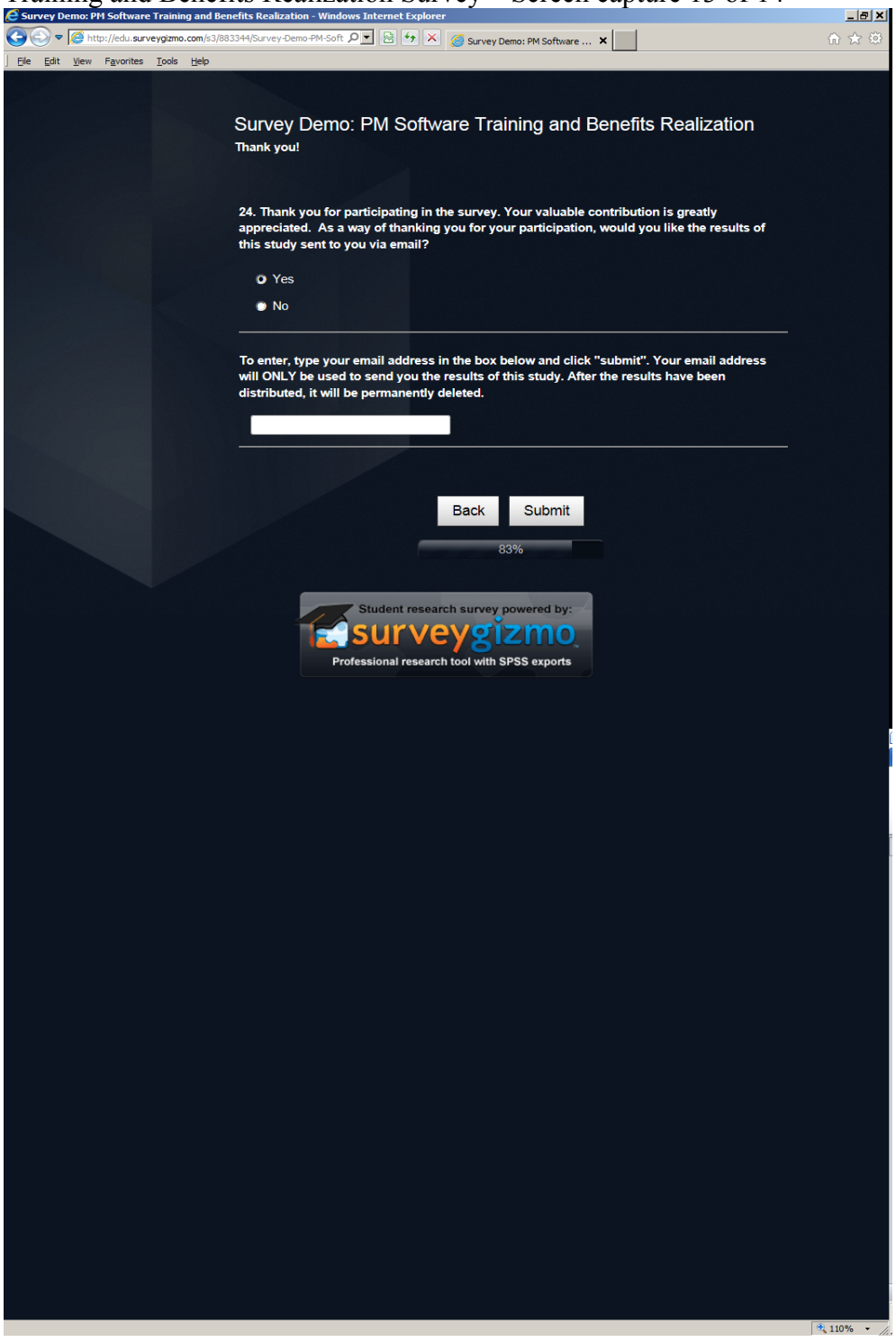
Training and Benefits Realization Survey – Screen capture 11 of 14



Training and Benefits Realization Survey – Screen capture 12 of 14



Training and Benefits Realization Survey – Screen capture 13 of 14



Training and Benefits Realization Survey – Screen capture 14 of 14

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