2017

Strategies for Improved Earned Value Management Use by Defense Business Leaders

Kevin Robert Rhodes
Walden University

Walden University

College of Management and Technology

This is to certify that the doctoral study by

Kevin Rhodes

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Irene Williams, Committee Chairperson, Doctor of Business Administration Faculty

Dr. Matthew Knight, Committee Member, Doctor of Business Administration Faculty

Dr. Yvonne Doll, University Reviewer, Doctor of Business Administration Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2017

Abstract

Strategies for Improved Earned Value Management Use by Defense Business Leaders

by

Kevin Rhodes

MS, Troy State University, 2003

BA, University of Florida, 1997

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Business Administration

Walden University

July 2017

Abstract

Project cost and schedule forecasting accuracy in the defense industry has not significantly changed since the 1960s, making it difficult for defense business leaders to implement successful earned value management (EVM) strategies. The purpose of this multiple case study was to explore EVM strategies that Washington, D.C. area defense contractor business leaders used to improve costs and schedule goal accomplishment. The conceptual framework for this study was the earned time theory. Data were collected from semistructured interviews from 5 defense contractor business leaders with demonstrated use of EVM strategy. The review of company documents focused on EVM use with reporting requirements, and archival EVM study analysis supplemented the data from the semistructured interviews. Data were triangulated and inductively analyzed for themes, and member checking was done to ensure credibility of the interpretations. Four themes emerged from the data: the use of EVM data to improve outcomes, the existence of essential strategies, the role of EVM as but a single tool, and the essential engagement of leadership. Findings may contribute to social change because defense business contractor leaders could help improve business performance and return resources for social improvement. Investment in social and environmental improvements can strengthen employee commitment and ultimately ties to the community at large, furthering social improvement.

Strategies for Improved Earned Value Management Use by Defense Sector Leaders

by

Kevin Rhodes

MS, Troy State University, 2003

BA, University of Florida, 1997

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Business Administration

Walden University

July 2017

Dedication

I dedicate this study and completion of my Doctorate in Business Administration to my mother and father and my maternal grandparents. While each of them has passed on, their love and encouragement continues to bolster me throughout my life. I carry their love and support with me and I will do so all the days of my life.

Acknowledgments

I would like to thank my committee chair, Dr. Irene Williams for her guidance, input, insight, and most importantly her positive commitment to my success in my doctoral journey. Her positive attitude was uplifting and encouraging throughout the entire process. I also would like to thank committee members Dr. Matthew Knight, my second committee member, along with Dr. James Savard and Dr. Yvonne Doll, university research reviewers (URR), for their immensely useful advice and input as well as their support through the journey.

I can give no greater thank you than to my wife and love of my life. Sandi, this doctoral accomplishment is as much yours as it is mine.

Table of Contents

List of Tables

Section 1: Foundation of the Study

Some defense business contractor leaders encounter problems meeting cost and schedule goals on projects (Kwak & Anabari, 2012). The problems with meeting defense project and cost goals occur even with use of monitoring systems such as earned value management (EVM) that provide insight into cost and schedule (Cantwell, Mazzuchi, & Sarkani, 2013). EVM can help project managers forecast issues, but project failures related to cost and schedule continue to occur at similar rates regardless of EVM use or EVM skill set teaching (Besterio, de Souza Pinto, & Novaski, 2015). The use of EVM provides insight into the cost of an effort from both a time and material set of parameters (Aliverdi, Naeni, & Salehipour, 2013). The likelihood of meeting cost and schedule goals is more probable to occur with a sufficient understanding of the cost and schedule associated with a project (Moy, 2016). Appropriate EVM strategy use that identifies cost and schedule issues to the project manager is a key component of project understanding (Moy, 2016).

Background of the Problem

Representatives of the U.S. Department of Defense created EVM in the 1960s for assistance in the attainment of project management goals (Kwak & Anabari, 2012). Since the 1960s, EVM adoption use occurred by many businesses, including significant use by the construction industry (De Marco & Narbeav, 2013). Researchers since 2010 have indicated that it is difficult to prove EVM use increased success in attaining cost and schedule goals without a concerted effort in tracking EVM data (Maheshwari & Credle,

2010). Further analysis has shown improvement of EVM outcomes with the improvement of planned values (PVs) used to build the initial estimates.

The use of EVM enhanced project management cost and schedule achievement for program managers with improved EVM values (Lu & Lu, 2013). EVM includes several values that form the foundation of the primary output of EVM such as estimate at completion (EAC) or estimate at completion for time (EAC[t]) (Chen, 2014). Additional examination showed with improved EVM values, expert knowledge, and application used with actual project data, this information could significantly reduce EAC deviation at project completion (Kim & Reinschmidt, 2011). While examination has proved that EVM can increase achievement of project management cost and schedule goals, project managers struggle with easy correlation and measurement of EVM value (Chen, 2014). Defense business leaders expend large amounts of resources using EVM, but cannot easily determine the strategies for using EVM that improve project cost and schedule outcomes (Kwak & Anabari, 2012).

Problem Statement

Defense project cost and schedule forecasting accuracy in the defense industry has not significantly changed since the 1960s, making it difficult for defense business leaders to implement successful EVM strategies (Mortaji, Bagherpour, & Noori, 2013). EVM paired with experience or other forecasting approaches can improve forecasting accuracy by more than 75% (Colin, Martens, Vanhoucke, & Wauters, 2015). The general business problem is that even though EVM use occurred for defense projects, the projects still failed to meet cost and schedule goals. The specific business problem is that some

defense contractor business leaders lack strategies for EVM use to improve cost and schedule goal accomplishment.

Purpose Statement

The purpose of this qualitative multiple case study was to explore EVM strategies that Washington, D.C. area defense contractor business leaders used to improve cost and schedule goal accomplishment. The population included defense contractor business leaders who are vice presidents, directors, supervisors, and program managers working at three defense companies in the Washington, D.C. area. I adjusted the exact number of participants based upon when data saturation occurred. These defense contractor business leaders work for defense-focused companies and have demonstrated successful EVM strategy use on defense programs.

The findings from this study could enable social change because defense business leaders could use additional resources to develop less harmful products that use less fuel, create less pollution, or use less environmentally toxic materials. When projects fall behind goals, project managers often deprioritize environmental improvements (Martinez-del-Rio & Céspedes-Lorente, 2014). The deprioritization of environmental improvements was due to the focus on returning the project back to baseline goals; however, with implementation of an effective EVM strategy, this deprioritization could be avoided (Martinez-del-Rio & Céspedes-Lorente, 2014).

Nature of the Study

I used a qualitative approach because I focused on the exploration of the participants' experiences. Because this study relates to EVM strategies from actual

demonstrated experience by defense contractor business leaders, the qualitative method was applicable. Quantitative researchers, in contrast, usually examine a causal relationship or relationship and difference between two or more variables (Groeneveld, Tummers, Bronkhorst, Ashikali, & van Thiel, 2015). Since I did not address a causal relationship or relationship and difference between two or more variables, quantitative methodology was inappropriate. A mixed method approach contains both qualitative and quantitative analysis (Patton, 2015). I did not address variables' relationships in this study, and thus the mixed method was inappropriate. For this study, it was crucial to use a qualitative method for a deeper consideration of strategy. Researchers stated that responses from a survey would likely not provide the rich data necessary for a deeper review that a qualitative method could provide (Marshall, Cardon, Poddar, & Fontenot, 2013).

Yin (2014) stated that the rationale for the use of a case study derives from a *how* and *why* relationship and focuses on a contemporary issue. In addition, a case study can be descriptive and focus on *what* issues such as strategy (Yin, 2014). Since I focused on a *what* issue—or strategy review--a descriptive case study was applicable. Case study design does not require control of behavioral events (Yin, 2014). An alternate design to a case study was a phenomenological design in which the researcher focuses on studying the lived experiences of participants and highlights a phenomenon multiple individuals have experienced (Khan, 2014). Determining what EVM strategies defense businesses employ was not an extraordinary experience and so a phenomenological design was not suitable. Another alternative was an ethnographic design using interviews, but

ethnographers focus on group culture (Corbin & Strauss, 2014), which was not applicable to this study. Narrative design was another study design option, but a narrative design involves participants telling stories (Khan, 2014). A narrative design was not appropriate for this study because a full narrative story was not required. By using a case study, I identified and explored themes related to EVM strategies in the defense sector that aligned with Yin's (2014) circumstances for case study use.

Research Question

What EVM strategies do defense contractor business leaders use to improve project cost and schedule goal accomplishment?

Interview Questions

1. What is your experience and background using EVM as a defense contractor business leader in your organization?
2. What EVM strategies have you used that improve a PM's ability to meet cost and schedule goals?
3. Why did you implement an EVM strategy for the projects at all?
4. How has using EVM improved project management in your organization?
5. What does EVM bring to a Project Manager's (PM) tool set to meet cost and schedule goals that other mechanisms do not?
6. What challenges have you encountered measuring the value of an EVM strategy on a project in the sense of positive or negative impact on cost and schedule goal accomplishment?
7. How were these challenges measuring the value of EVM addressed?

8. What implementation processes did you use to gain the most value from EVM use?
9. What additional considerations would you like to add regarding the use of EVM and EVM's value as a process in project management?

Conceptual Framework

The conceptual framework for this study came from the earned time theory. The theory provides a strong foundation to identify and explore answers to the research question. Efficiency experts, the Gilbreths, created earned time theory in the early 20th century (Gilbreth & Carey, 1948). The Gilbreths asserted that time for completion of a task has value (Gilbreth & Carey, 1948). The U.S. government created EVM theory in the late 1960s to improve project management of defense systems (Kwak & Anbari, 2012). The foundation of EVM comes from earned time theory (Sasirekha & Tripathi, 2013). EVM use has since migrated to other industries outside of the government (Kwak & Anbari, 2012). EVM theory identifies that work is broken down into packages with a cost and schedule value associated with completion of the work packages (Mortaji et al., 2013).

The early detection or forecasting of issues can help save resources in a project (Kwak & Anbari, 2012). Chen (2014) stated that with accurate EVM use, improved comprehension of the project across all aspects of the project occurs. Implementation of EVM strategy in project management can provide reliable project management cost and schedule forecasts and actual value estimates for assessing progress and support managing the cost and schedule of the project (Ancosky, 2013). This conceptual

framework was applicable to the study because a thorough understanding of useful EVM strategies occurred during the study. With useful and actionable EVM strategies, defense contractor business leaders in the defense industry can improve project cost and schedule forecasts and improve outcomes.

Operational Definitions

Actual Cost (AC): Actual cost was the aggregate definite cost value either as a constant or intermittent sum of the real cost of work accomplished to date (Chen, 2014).

Actual Cost of Work Performed (ACWP): Actual cost of work performed was the cost value of completed work as opposed to planned cost or the *BCWP* (Czemplik, 2014).

Budgeted Cost of Work Performed (BCWP): Budgeted cost of work performed was the planned value for completed work as opposed to the actual value or *ACWP* (Czemplik, 2014).

Budgeted Cost of Work Scheduled (BCWS): Budgeted cost of work scheduled definition happened before the start of work and was a planning value for cost related to schedule time (Czemplik, 2014).

Cost Performance Index (CPI): Cost performance index was a metric that reflects the relationship between completed work and the planned budget for finished work in relation to the AC or the budget expended for the work (Hunter, Fitzgerald, & Barlow, 2014).

Earned value (EV): Earned value was the summation of completed work against the planned work budget to date (Chen, 2014; Acebes, Pajares, Galán, & López-Paredes, 2014).

Earned value management (EVM): Earned value management was a method for program management that collects EV cost and schedule data for predicting final cost and schedule requirements for project completion (Chen, 2014; Hazır, 2015).

Performance Measurement Baseline (PMB): A performance measurement baseline was a standard by which a reviewed project's progress provided a reference point of planned work that was accounted for in the budget while showing progress as work occurred (Mir & Pinnington, 2014; Shah, 2014).

Schedule performance index (SPI): A schedule performance index reflects the relationship between the actual schedule and the planned schedule that represents the relationship between the achieved schedule and the planned schedule (Hunter et al., 2014).

Work breakdown structure (WBS): A work breakdown structure was a graphical representation of required work for a project presented in a tree diagram that reflects numerous areas of effort for the respective project (Vanhoucke & Colin, 2016).

Assumptions, Limitations, and Delimitations

Assumptions

Researchers, with selection of any research design, use some assumptions that underpin and support the overarching study focus (Brinkmann & Kvale, 2014). Assumptions are those ideas that are considered true and are treated as facts without verification by researchers (Marshall & Rossman, 2016). I made two assumptions in this study. The first assumption was that the EVM strategies that I reviewed have some level of transferability across defense projects. The second assumption was that the

participants were honest in their responses and experience in using EVM to meet cost and schedule goals for defense projects.

Limitations

Limitations are shortfalls or possible weakness in research (Cunha & Miller, 2014). Several limitations were evident in this study. The first limitation was personal bias that derives from my extensive experience with EVM use in defense projects that could have influenced the data collected in the interview process. The amount of bias present in a study affects the perceived credibility of the research (Tuohy, Cooney, Dowling, Murphy, & Sixmith, 2013). Bracketing personal experiences is an acceptable approach in academic research but removing all bias is unlikely (Marshall & Rossman, 2016). I used bracketing to reduce the impact of my personal biases.

The second limitation was that while demonstrated EVM strategy collection occurred that improved cost and schedule outcomes in defense contractor projects, determining the most effective strategies was not part of this study. Defense contractor business leaders will need to evaluate the strategies most appropriate for their project based on that respective project's bounds. Reviewing the advantages of particular EVM strategies is an opportunity for future research.

Delimitations

The scope of a study is established or narrowed with defined study delimitations (Domingos et al., 2014). I limited the study to demonstrated strategies by defense business contractor leaders. Furthermore, participants were limited to those defense business leaders that are in some type of leadership role who have been able to influence

the implementation and use of an EVM strategy on a defense project. A refined scope in case study research is key for an appropriate sampling technique (Marshall & Rossman, 2016).

An additional delimitation was that evaluation of EVM strategy effectiveness did not occur. I did not investigate behavioral aspects such as employee opinion of a strategy of the effect of EVM use on personnel. Furthermore, I did not explore the relationship between EVM variables within the EVM equation relative to EVM strategy effectiveness.

Significance of the Study

This study might be of value to defense contractor business leaders because the use of EVM strategies could lead to improved cost and schedule outcomes for projects. EVM can help project managers build foundational strategies for project management processes. Project managers continually encounter cost and schedule overages, and EVM provides advanced knowledge of those issues (Elshaer, 2013). While awareness of the issues was helpful, having a strategy to mitigate the issues with the available data was a higher-level capability.

Business owners should collect not only EVM data, but also understand EVM strategy for project management and project outcome improvements. If a strategy identified a more effective way to use EVM and gain value from it, resources no longer required for the project could return to the organization for other uses (Donovan, 2015). The results of this study may assist project managers and enterprises with strategies for improving outcomes with EVM.

Socially responsible and environmental improvements continue to gain traction in most business sectors (Lubber, 2015). Defense contractor business leaders concerned with effecting beneficial social change could gain value from this research because, with the results, they could help improve business performance and potentially return resources for social improvement (Ducassy, 2013). Investment in social and environmental improvements can strengthen employee commitment and is ultimately connected to the community at large (Ellinger et al., 2013). Consumers were concerned with how companies address environmental issues and positively supported companies that focus on environmental improvement (Ioannou & Serafeim, 2015). Business leaders that improve environmentally stay competitive and can continue to focus on socially responsible issues (Martinez-del-Rio & Céspedes-Lorente, 2014). Defense business leaders could apply resources gained from efficiency to development less harmful products that use less fuel, create less pollution, or use less environmentally toxic materials. Potential exists for these environmental improvements to migrate to other industries, thus continuing social improvement. A more successful business may also improve society with additional jobs, technological advancement, and overall improvement of the community.

A Review of the Professional and Academic Literature

The purpose of this study was to explore EVM strategies implemented by defense business contractor leaders. An in depth review of the literature involved extensive research into EVM and the associated strategies demonstrated in defense businesses. A review of the themes in current EVM research confirmed EVM use could improve

meeting cost and schedule goals for projects when EVM use transpired. While the study focus was on EVM strategies, project management requires the use of a multidisciplinary approach. In broad terms, program managers that work in the defense industry use EVM (Townsend, Mazzuchi, & Sarkani, 2014). EVM use occurs to access cost, evaluate schedule and performance, evaluate planned work against completed progress, and determine how resources are used (Townsend et al., 2014).

I conducted cross reference research from a broad and extensive list of EVM terms, including such terms as *EVM improvement, earned schedule improvement, EVM strategy use,* and *project forecasting with EVM use.* An assortment of academic databases such as ProQuest, ERIC, and Business Source Complete supported the review and was available through the Walden Library. Google Scholar linked to the Walden Library assisted me in gathering relevant articles free of charge. Peer-reviewed articles contributed greater than 85% of the sources used and more than 85% of the sources were less than 5 years old. Ulrich's Web Global Serials Directory supported the verification of peer-reviewed articles. A limited number of sources used were outside the 5-year recent period for support of the conceptual framework, as well as foundational support for the overall study.

Journal articles and source selection resulted based on applicability to this study and not on the EVM research area as a whole. Table 1 below is a summation of the sources used in my research.

Table 1

Summary of Sources

	# of Sources	% of Sources
Literature Review	70	
Peer Reviewed	66	94%
Less Than 5 Years Old	61	87%
Full Study	112	
Peer Reviewed	107	96%
Less Than 5 Years Old	97	87%

A large portion of the research that I studied was quantitative in nature. EVM quantitative research was more common than qualitative research due to the mathematical and variable relationship within the EVM equation itself. With such a large amount of quantitative research data available, a qualitative review was ideal because triangulation in social sciences is a valuable way for reliability and validity verification (Marshall & Rossman, 2016). Qualitative research allows the researcher to focus on the exploration of a participant's experiences and perceptions in the world with a deeper relationship between the participant and the researcher (Finlay, 2014). A shared experience between participants and the researcher allows exploration of the topic in a deeper way because of an empathy understanding relationship (Finley, 2014). Empathetic research does not introduce bias, but rather a sensing of the participant for a better understanding of the experience (Finley, 2014). Qualitative research allowed me to

conduct an exploration of EVM strategies versus statistical values that quantitative research would have provided. Interviews with the participants facilitated a strategy analysis that responses from a survey or statistical quantitative review could not provide (Marshall et al., 2013).

The literature review is the foundational starting point for a study after a potential research area is determined (Marshall & Rossman, 2016). An understanding of existing research, gaps in the existing research, and themes came from the literature review (Marshall & Rossman, 2016). The literature review also allowed refinement of the research and interview questions (Marshall & Rossman, 2016). The credibility, transferability, dependability, and confirmability of the research derived from the literature review because the literature review reflected the depth and extent of the research (Corbin & Strauss, 2014). Earned time, as the conceptual framework underlying theory, provided the stance by which I reviewed and analyzed the literature and built this multiple case study. The prevailing themes from the literature review were (a) improvement of EVM estimating values, (b) EVM analysis as a skill set, (c) strategy consideration, (d) accounting for risk using EVM, and (e) leadership style and EVM use.

Application to the Applied Business Problem

The purpose of this qualitative multiple case study was to explore EVM strategies that Washington, D.C. area defense contractor business leaders were using to improve cost and schedule goal accomplishment. Business leaders in the defense industry struggle with the application of EVM strategy toward improved cost and schedule outcomes (Ancosky, 2013). In this qualitative case study, I examined EVM strategies for

business leaders at defense companies with application to the problem of determining EVM strategies that can improve cost and schedule goal accomplishment. With much of the existing EVM research focused on improvement of the EVM equation itself, the existing quantitative research failed to provide sufficient strategies for the use of EVM in improvement of cost and schedule outcomes. Relevant qualitative strategy exists with the basis determined on the quantitative EVM studies, but a deeper review is necessary (Batselier & Vanhoucke, 2015). The business problem and research question were rooted in the foundational conceptual framework of earned time.

Conceptual Framework Foundation

Understanding of the conceptual framework in a qualitative study is key to a deep review of the research question. The way in which the phenomenon under review started supports further research into the area of study through a recognition of where the research came from and began (Wiesenfeld & Brockner, 2012). Understanding how previous researchers examined the research and treated the conceptual framework understanding helps current researchers frame current research and creates a research question (Marshall & Rossman, 2016). Earned time theorists, the Gilbreths, stated that work has a value in both time to do the effort and a cost associated with the respective effort (Gilbreth & Carey, 1948). As efficiency and motion study experts, the Gilbreths looked for ways to improve and increase productivity in industrial-based industries by reducing wasted action. The ability to induce efficiency first came from understanding the time and cost with producing a product (Gilbreth & Carey, 1948). By understanding the foundation of the work in segments, efficiency introduction occurred in production by

removing unnecessary effort and induced an improvement in the learning curve for workers (Gilbreth & Carey, 1948).

The Gilbreths sought to reduce unnecessary motions in industrial production or construction by studying the most efficient way to complete a task (Gilbreth & Carey, 1948). F. Gilbreth, for example, introduced a platform that remained level to the current bricklayer under work to reduce brick masons bending over to pick up bricks (Gilbreth & Carey, 1948). The improvements to the bricklaying process migrated to large projects such as bridges and significantly reduced completion times (Gilbreth & Casey, 1948). By reducing the time to complete a project, cost reduction normally happened as well (Gilbreth & Casey, 1948). Cost reduction resulted in many products being cheaper and produced in larger numbers (Gilbreth & Carey, 1948). This cost reduction happened because learning occurred that reduced the time for the effort until eventually a flattening of the efficiency when the learning curve was achieved (Gilbreth & Carey, 1948). F. Gilbreth focused on removing inefficiency in even simple effort and practiced teaching techniques to children (Gilbreth & Carey, 1948). Economies of scale and earned time are now foundational concepts across industry and governmental entities alike (Chaplin, 2015). In addition, the drive to reduce wasted effort exists throughout production-based industries.

The motivation for my analysis into earned time theory supported review of current EVM theory analysis and the reasoning of why EVM strategy use might improve cost and schedule project outcomes. The majority of the research that I reviewed relied on the EVM theory created in the 1960s by representatives of the Department of Defense

(Kwak & Anbari, 2012). Originally, the theory for cost and schedule improvement was the program evaluation review technique/cost (PERT/Cost) within the government, but later the PERT/Cost method became EVM (Trietsch & Baker, 2012). PERT/Cost development came from the recognition by government leaders that program managers underperformed relative to cost and schedule goals (Hunter et al., 2014). Researchers consider early earned time theory questions of value for EVM research (Trietsch & Baker, 2012).

Current EVM theory used by project managers derives from previous variations of earned time theory and efficiency thought. There are several theories related to cost and schedule analysis contributed to the current EVM theory (Kwak & Anabari, 2012). This includes PERT/Cost and other variations. Some of the government's iterations on earned time failed because they became overly burdensome for capturing useful information (Kwak & Anabari, 2012). Some of these EVM methodologies also failed to answer the basic question of earned time concerning how to determine the value of work and ultimately induce efficiency (Gilbreth & Carey, 1948). Improvements made from the early theories by project managers and researchers contribute to EVM effectiveness today. While the variations of EVM provided a useful foundation of EVM as EVM is today, the variations all relied on earned time for the principal ideas.

Originally, the individuals applying earned time to projects relied on defining the value of work to create efficiency in the manufacturing process. Project managers now use EVM to improve clarity into cost and schedule accomplishment against a planned project baseline (Kwak & Anabari, 2012). EVM supported my review of efficiency into

the process by understanding the value of a work effort (Gilbreth & Carey, 1948; Kwak & Anabari, 2012). Private contractors working on government programs are now required to use EVM as a measurement methodology for cost and schedule (Moy, 2016; Plummer, 2010). The success indicated by EVM use on government projects has supported the migration of EVM use to other industries (De Marco & Narbaev, 2013). EVM has now become an important tool for defense contractor business leaders monitoring cost and schedule performance (Hunter et al., 2014). As a program progresses, defense contractor business leaders are ultimately able to gauge final cost and schedule and adjust as necessary for goal accomplishment (Gershon, 2013). EVM continues to undergo review by project managers and researchers for improvements for goal accomplishment.

Several different academic researchers (Moy, 2016; Plummer, 2010; Shah, 2014) studied EVM theory and, by relation, earned time theory as the underlying foundation of EVM. Plummer (2010) studied EVM in relation to EVM use on information systems projects and the effects of using EVM on the projects under Plummer's review. The analysis included Plummer's review of data back to the 1970s up to within a few years of the 2010 published results. While EVM proved helpful, almost 65% of the software for Plummer's selected government Information Technology (IT) programs were not useful, and ultimately 98% of the software required rework (Plummer, 2010). Plummer's use of EVM pointed out issue areas but adjustments did not change the outcomes. Plummer did not identify earned time out right, a gap reflected in much of the current EVM research, but Plummer did seek analysis into earned time and efficiency of effort by reviewing IT

systems and their failure to understand the amount of time and effort actually associated with an IT effort.

Other research I reviewed focused on EVM and associated project principals such as project risk related to project accomplishment. Shah (2014) completed a study focused on EVM and the close association with risk management. Results from Shah's study showed program managers using a project management approach with both EVM and risk management had better cost and schedule outcomes than program managers who did not (Shah, 2014). EVM analysis was useful for program managers because completed work helped the Shah study program managers determine trends and identify areas or concern and issues. Risk management included the planning for and consideration of future issues that EVM use alone might not identify because issues have not occurred yet against a baseline (Shah, 2014). The two-project management methods paired together offered an opportunity to look at a project's timeframe from start-to-finish (Shah, 2014). While Shah did not readily identify earned time and the question of value for work, Shah analyzed the basic question of earned time by identifying program risk and the work associated to overcoming risk has a value. The use of EVM along with risk management offers the opportunity for additional improvement as opposed to EVM alone. Other researchers, such as Moy (2016) focused on similar ideas.

A specific set of projects considered for improvement related to EVM use and improvement of cost and schedule outcomes was IT projects. Moy (2016) completed a study that built upon Plummer's (2010) review into Federal IT programs and success with EVM use. Moy's extensive quantitative research sought a variable relationship

between use of EVM and effective IT program management. Similar to other quantitative studies such as the Chen (2014) study, Moy considered EVM values such as Schedule Variance (SV) and Actual Cost (AC) incurred and then evaluated for a relationship that would indicate project success against the baseline. Conclusions from the study showed a relationship between EVM values and IT program success existed (Moy, 2016). Like most of the other research reviewed, Moy did not directly identify earned time, but she did recognize EVM as a theory and that EVM captures value in terms of cost and schedule. While a relationship may exist between values, a strategy for application of this knowledge would be helpful for defense business contractor leaders.

By using the selected interview questions, I have helped provide insight into the original thoughts outlined in earned time theory and the current EVM theory. A further review of the conceptual theory occurred with analyzing the collected research data. In the Presentation of Findings in Section 3, I pointed back toward the conceptual framework for encapsulating and displaying the results.

Improvement of EVM Estimating Values

An understanding of how an EVM system comes together is an important first step in considering EVM strategy and improvement. An EVM system derives from work packages that account for effort in terms of cost and schedule (Chen, 2014). EVM can then help leaders manage and relate an organization's EVM system for a project, which allows an organization to adjust, plan, and forecast a program in relation to the original planned scope (Townsend et al., 2014). EVM is a forecasting model that can provide projected EAC for the timeframe considered in the baseline to the total cost of a project

when completed (Chen, 2014). EVM can also provide the amount of time necessary for the completion of a project or EAC(t) (Chen, 2014). EAC and EAC(t) support the project management multidisciplinary approach by allowing a focus on areas that are lagging projections and the use of engineering, financial, or contracting strategies to address problems (Hunter et al., 2014). While EVM supports project management efforts, EVM is only as good as the input used (Mostafa, Bagherpour, & Kamyabniya, 2014). The lack of quality data or improvement in project management outcomes causes a lack of confidence in EVM use and the setting aside of EVM for the project (Donovan, 2015). While EVM provides valuable insight into the cost and schedule of a project, business leaders should understand the data from EVM and have confidence in the information EVM reflects.

The aggregate data EVM systems reflect derives from lower level input and accuracy is important. Research exists (Chen, 2014) regarding EVM use and its improvement related to refining EVM outcomes. Much of this research has focused on improvement of the estimating values in the EVM foundation (Chen, 2014). Caron, Ruggeri, and Merli (2012) reviewed EVM, estimating value improvement in their study that included an evaluation of EVM using a Bayesian approach. Caron et al. then conducted research with the application of subjective analysis from multiple construction experts' that were participating in the study (Caron et al., 2012). The participant's tacit knowledge and observations from previous projects, in conjunction with the collected EVM data, supported the study (Caron et al., 2012). The participants' prior knowledge interwoven into the distribution model through mathematical application supported the

data collection (Caron et al., 2012). After the creation of the model, the researchers utilized the model in a gas pipeline project (Caron et al., 2012). Application of the participating experts' opinions to the PVs helped refine the EVM values (Caron et al., 2012). The model provided a pivotal step but further research was necessary for a deeper improvement consideration.

Testing the model with a real project was a good idea because it showed actual application. While it was subjective analysis for the PVs, the hypothesis was that expert experience could improve EVM accuracy more than standard estimation techniques (Caron et al., 2012). The study results validated the theory that expert opinion improved EVM accuracy by using a distribution model with completion results (Caron et al., 2012). The statistical distribution showed results that aligned more with the actual values at project completion when the subjective expert opinion was part of the EVM estimation method (Caron et al., 2012). The importance of this particular study was that Caron et al. reviewed a construction project through completion and then analyzed the results. The application of the study in the gas pipeline project verified EVM as more than theoretical analysis with a practical application (Caron et al., 2012). Other researchers could either align with, or counter EVM use as improving project outcomes through their research.

The use of EVM does not always show measurable project improvement. Other researchers reviewed EVM utilization and project management success and reported that EVM did not necessarily improve project management outcomes more than other project management mechanisms (Acebes, Pajares, Galán, & López-Paredes, 2013; Haji-Kazemi, Andersen, & Krane, 2013). Some studies, including the Caron et al. (2012)

study, showed that the subjective use of expert opinion proved just as useful. Expert opinion use was relative to PVs as well as overall EAC and EAC(t) outcomes. The Caron et al. study (2012) showed that against a dispersion model for cost and schedule goals, individual expert opinion was as useful in the outcome as EVM data. Expert opinion could help defense business contractor leaders but similar to using EVM at all, understanding a strategy for using expert opinion would be useful.

Project managers that use EVM can benefit from refining EVM inputs because as a mathematical and statistical based system, EVM outputs can improve from increased input accuracy. Chen (2014) further validated that EVM validity improved by refining the legitimacy of planned values in the EVM modeling. The ability to adjust projected values for better outcomes came both from a quantitative mathematical formula and the use of experience based opinions (Chen, 2014). The difference in the Chen study as opposed to other studies was that Chen chose to review numerous methodologies to improve PVs rather than reviewing a particular technique. The hypothesis was that PV accuracy improvement increased EVM accuracy and project management success but that some procedures were more effective than others (Chen, 2014). When PVs adjustment occurred, Chen used statistical analysis to check EVM accuracy with linear alignment. The process of adjusting PVs throughout the process based on analysis followed as data transformation in the EVM system (Chen, 2014). For the data transformation, Chen relied on linear regression and ultimately determined that the foundational improvement of the PVs had direct correlation to EAC and EAC(t). PVs are a significant part of EVM, so improvement of PVs should have positive impact on overall

outcomes. Improvement of a part of an EVM system can have improvement on the overall EVM system.

Related to PVs in an EVM system is level of effort (LOE) tasks that do not have a discreet value. Researchers in another study (Townsend et al., 2014), similar to Chen (2014), sought to improve the estimation for LOE tasks that supported overall EVM value output. The issue with LOE tasks is that the work is not associated with a discrete task, but rather a LOE bridge task across functional areas (Townsend et al., 2014). An example is the overall effort across the engineering expertise that is required in a project but does not directly tie to a discernable engineering task (Townsend et al., 2014). Workforce management of engineers is required but does not have an easily measurable task (Townsend et al., 2014). These efforts still need captured in overall project workload (Townsend et al., 2014). Townsend et al. (2014) proposed a new methodology that captures the LOE work for project completion at an overarching level. While the Townsend et al. study improved EVM accuracy, Townsend et al. did not propose a strategy for EVM use that could improve EVM use for project managers.

The issue with PVs for level of effort tasks is that the tasks derive from estimation across broad areas as opposed to specific effort. Estimation for a specific task comes from a previous effort and experience (Caron et al., 2012). An example provided by Caron et al. (2012) was a construction project concerning drilling for water. The project managers used previous construction efforts for time estimation required for the well construction (Caron et al., 2012). The issue with LOE is how does the project manager determine if the right amount of LOE is used or should it increase or decrease LOE tasks?

The methodology used in the Townsend et al. (2014) study suggested a way to improve PVs for LOE tasks and proved that this methodology was useful for accuracy improvement and ultimately EVM use.

The opportunity for improvement with EVM exists if the values used in the EVM methodology improve. A review of the existing literature showed that EVM accuracy improved if the estimating values were refined for accuracy (Chen, 2014). LOE task estimation improved from a similar process of value estimating improvement (Townsend et al., 2014) and when value improvement occurred in the EVM system, confidence in EVM increased with project managers (Chen, 2014; Townsend et al., 2014). The overall improvement of the EVM accuracy planning values improved EVM use and strategy determination (Chen, 2014). Improvement of EVM estimating values could have a positive impact on EVM strategy for cost and schedule goal improvement.

EVM Analysis as a Skill Set

Project managers that lead Department of Defense programs continue to not meet cost and schedule goals. Defense acquisition project managers encounter issues such as inaccurate cost estimates, schedule delays, requirement changes, and burdensome bureaucracy (Cantwell et al., 2013). EVM is acknowledged within the defense industry as an effective program management method for cost, schedule, and risk management in projects and has helped project managers address some of the identified issues (De Marco & Narbaev, 2013). Some leaders within industry are not prepared to use EVM due to organizational project management immaturity and organization acceptance (Gershon, 2013). Program managers seek to meet the three pillars of success in broad terms for a

project. The three pillars are cost, schedule, and performance parameters (Cantwell et al., 2013). These three parameters, or objectives, set the bounds or environment in which the program manager or project team and leaders operate within (Lech, 2013). While program managers are aware of the bounds they operate within, using any management means available such as EVM should bring the most likely chance for success.

A management tool available to leaders is the people available to do the work. Defense contractor business leaders build project teams comprised of people from numerous disciplines such as engineering, logistics, finance, contracting, program management, and various other disciplines that attempt to meet cost, schedule, and performance parameters (Drury-Grogan, 2014). EVM is a tool that across all the project management disciplines can help meet goals (Drury-Grogan, 2014). Ultimately, EVM supports better decision making through knowledge and with better decisions, better outcomes and more buy-in from stakeholders occurs (Beringer, Jonas, & Kock, 2013). Defense contractor business leaders could make better decisions with appropriate teams and adequate knowledge.

Leading a project for project managers is a complex task with many interdependencies. A significant number of defense program managers fail to correct underperforming programs in respect to cost, and schedule goals because they do not understand the complexities involved (Cantwell et al., 2013). Besteiro et al. (2015) analyzed the skills most important for program managers to use during project management and reported EVM use and EVM understanding as the key attributes. Project managers' ability to analyze PVs and comprehend those PVs with changes as the

project progressed under the monitoring and control skill set was very important (Besteiro et al., 2015). In a related study, Brigham and Hayes (2013) found information technology and the ability to collect the right data for PVs development was important for project managers in the program manager skill set. The project manager's adjustment of the PVs required the right information through the program manager's ability to ascertain the correct data to use (Brigham & Hayes, 2013). During a Government and Accountability Office (GAO) review of Space Systems, the GAO determined that the EVM used on some projects lacked credibility because a review showed that an appraisal of the PVs did not happen for accuracy using the right tools (Chaplain, 2015). The GAO provided that without an analysis of the EVM values, the credibility of the EAC and EAC(t) was suspect (Chaplin, 2015). The GAO review validated that a project manager should understand the complexity of a project and of PVs for success.

One of the complexities of a project is how work allocation takes place across the project. A key for project management success, aside from selecting the most appropriate EVM method, is alignment of the work breakdown structure (WBS) within the overall project cost and schedule (Khamooshi & Golafshani, 2014). The WBS assists project managers in understanding the scope of the project and assists in the comprehension of the necessary work (Khamooshi & Golafshani, 2014). As Narbaev and De Marco (2013) found in another business sector, the construction industry, project managers required a full understanding of scope for the best project outcomes. Just as defense project managers must align the WBS for scope, cost, and schedule, construction project managers should do the same (Narbaev & De Marco, 2013). EVM improvement

has migrated across industries but project managers still require an understanding of their project and while understanding how to utilize EVM.

Consideration of how to show EVM data is an important part of EVM use. EVM is one of the most widely used and recognized ways to monitor and ultimately manage projects (Colin et al., 2015; Kwak & Anbari, 2012; Willems & Vanhoucke, 2015). Graphically capturing the data from EVM use is part of the program manager skill set and helps support successful project management (Byung-Cheol & Seong-Jin, 2015). As part of the surveillance system, project managers should understand the data and ensure reliability in the data (GAO, 2012). In a review of EVM use, Hunter, Fitzgerald, and Barlow (2014) showed that inclusion of an understood metrics system by the project team tied to the EVM formal surveillance system helped guide the project toward success. Effective metrics that tie to the EVM system can extend the value of EVM use as well as improve other management areas such as risk management (Acebes et al., 2014; Colin et al., 2015). EVM deviations shown graphically from the baseline help direct corrective action and highlight successful work areas for migration of lessons learned (Naeni, Shadrokh, & Salehipour, 2014; Salari, Bagherpour, & Kamyabniya, 2015). My review of existing research showed metrics are a useful part of EVM application for project managers.

The use of EVM by project managers is a project management skill and should be considered by project managers. EVM can be an effective program management tool for cost, schedule, and risk management in projects (De Marco & Narbaev, 2013). Consideration of EVM as a skill set is helpful in project management (Besteiro et al.,

2015). The development of EVM as a skill set supports EVM strategy development as the skill set becomes refined and better supports by project outcomes. EVM use as a skill, paired with other project management methods such as WBS alignment by project managers improves EVM strategy development.

Strategy Consideration

An EVM method derives from different collected and defined data sets or values and individual EVM values can have an impact on EVM strategy. Project control using EVM consists of evaluating project progress against a planned baseline (Acebes, Pajares, Galán, & López-Paredes, 2014). EVM analysis involves gathering data regarding project scope, cost, and schedule. Acebes, Pajares, Galán, and López-Paredes (2014) stated there are three primary values project managers collect with EVM use. These values are budgeted cost for work scheduled (BCWS), actual cost for work performed (ACWP), and earned value (EV), or the budgeted cost of the work performed (BCWP) (Acebes et al., 2014). A review of these values throughout a project's timeline determines the variance of project accomplishment from the original plan (Acebes et al., 2014). When considered in an objective manner, these values provide early warning of project issues (Aliverdi et al., 2013). In my review of the literature, I found a scholarly consensus that knowing the variance in a project can help with project accomplishment.

Project managers in the defense industry have encountered significant project deviation from original planned baselines. Some of the project deviation is because project baseline variance was unknown (Hunter et al., 2014). Researchers conducting studies in the academic and industrial realms have studied project failures related to

scope, reduced budgets, and timelines (Mir & Pinnington, 2014; Ramos & Mota, 2014). A key to determine project variance is with EVM use, which can support improved project outcomes (Kwak & Anbari, 2012; Moy, 2016; Shah, 2014). As Chen (2014) pointed out, the more accurate the lower level EVM values such as BCWS, the more understanding a project manager can have into the deviance. Defense business contractor leaders should consider EVM strategies for project management improvement toward baseline plans.

EVM use and strategy has changed little in regards to the data provided to a project manager. Traditional project managers have used EVM for decades with the standard approach to data collection (Aliverdi et al., 2013). Project managers have focused on variances related to cost or schedule, and deviation from the baseline value of one (Aliverdi et al., 2013). An issue with this approach to data collection is that if the project remains close to the baseline, deviation is largely ignored (Aliverdi et al., 2013). However, Aliverdi et al. (2013) noted that small aberrations from the baseline indicate future problems in the project. EVM review methods are available that apply statistical analysis to the collected EV values that project managers can use to help determine baseline deviation (Aliverdi et al., 2013). Project managers should look for variance in the EVM values as an indicator of project issues.

Project managers might find statistical review useful when making project decisions. Project managers compare EVM values against each other during project reviews from different periods in the baseline (Aliverdi et al., 2013). A statistical review during a project review can show small trends that may help a program manager with

future management decisions (Aliverdi et al., 2013). For example, even if a project has stayed within the overall variance and close to the baseline value of one (the numeric value of one is used in EVM for a program that remains aligned with the cost and schedule baseline), a deeper statistical review may show small variation in different work areas. A closer look at the project via statistical analysis may indicate a problem with production or with a subsupplier, for instance. The subsupplier may have experienced production issues, but because of where the overall project was early in design and manufacturing, the subsupplier was able to overcome the problem. When the project goes to full scale, the subsupplier may not meet demand. With the statistical EVM review, the project manager can address the potential problem in advance because the deeper EVM analysis provides a useful performance trend against the project baseline. This statistical review strategy is one example of an EVM strategy a defense project manager could apply for project management. When managing multibillion dollar projects, mitigating problems in advance can save significant resources.

Different EVM methodology improvements exist that have improved project outcomes. Czemplik (2014) proposed using Monte Carlo simulation as one methodological improvement. Monte Carlo simulation modifies the basic EVM curves with minimum, maximum, and most likely ACWP, BCWP, and BCWS (Czemplik, 2014). By determining minimum and maximum limits using Monte Carlo simulation, projects managers are better able to manage project risk. Project managers in the Shah (2014) study determined where the applications of limited or additional resources were required for risk management after project review. Not only is current project status

important for project managers, but future risk is also an important aspect of project management using EVM (Czemplik, 2014). While EVM supports the forecasting process, risk identification supports the problem management process and relates to the systems engineering process (Olson, Mazzuchi, Sarkani, & Forsberg, 2012).

While different approaches exist for EVM use, project managers should consider what would work best on a particular project. Batselier and Vanhoucke (2015) stated that while many novel approaches in regards to EVM refinement exist, not all the approaches have been useful for all project management applications. There are several types of EVM analysis which include deterministic approaches that apply value to a point in time in the project baseline (Batselier & Vanhoucke, 2015). The deterministic EVM approach has been the traditional method for estimating cost and schedule values (Batselier & Vanhoucke, 2015). A review of the values against the baseline for project progress transpires with the deterministic EVM approach (Batselier & Vanhoucke, 2015). Another type of EVM approach is the probabilistic kind (Batselier & Vanhoucke, 2015). Project managers use the probabilistic approach to collect the likelihood of occurrence of project events, and then mark them on scales such as S-curves (Batselier & Vanhoucke, 2015). The probability of occurrence provides a range that the project manager can use to determine the acceptable range and adjust as necessary (Batselier & Vanhoucke, 2015). An extension of probabilistic method is the use of fuzzy numbers (Batselier & Vanhoucke, 2015). This method accounts for variance in estimating and supports probabilistic methods. While different EVM methods exist, an understanding of the project bounds by the project manager is important to project success.

The parameters of a project should help the project manager determine which EVM approach to use. A project manager should analyze the scope of the project and the resources available, and then determine the best approach to use (Reich, Gemino, & Sauer, 2014). Knowledge of the project helps define whether a deterministic or probabilistic approach is best (Reich et al., 2014). Knowledge management across the project team supports this determination, and in the longer term helps the project meet its goals (Reich et al., 2014). An effective way to determine the best approach comes from analysis of the existing approaches and alignment of project scope (Batselier & Vanhoucke, 2015). Many EVM approaches exist, but not all have useful application for every project (Batselier & Vanhoucke, 2015). Selecting any EVM approach for use, as opposed to a deep understanding of the project and then applying an EVM approach, would not prove useful.

Small variations of existing EVM approaches do not help if project managers do not comprehend the project. While EVM has existed for some time, and many EVM approaches exist with different variations, projects still fail (Haji-Kazemi et al., 2013). The selection of the right EVM approach is important, but more important is the use of the early warning signs (EWS) that EVM provides (Haji-Kazemi et al., 2013). Project managers need to interpret data in a useful way as the EWS points to trends or give early indication of upcoming problems (Haji-Kazemi et al., 2013). EWS allows project managers the ability to make informed decisions when changes to the baseline are required (Khamooshi & Golafshani, 2014). A project manager who understands the

project first and then applies the appropriate EVM strategy and application seems to have the most likely chance of meeting cost and schedule goals.

Accounting for Risk with EVM

Another area defense contractor project managers need to consider when using EVM is how to account for risk. These leaders should decide how to address project risk and whether to mitigate the risk, avoid the risk, or address the risk (Shah, 2014). Researchers such as Thamhain (2013) have indicated that the lack of risk accounting has had negative impacts on project management success. Project managers in the Thamhain study considered the alignment of additional resources against high-risk areas while considering additional sensitivity analysis in the EVM system. Complexity of the effort by the project manager is a key consideration of the risk in relation to project management (Turskis, Gajzler, & Dziadosz, 2012).

In other business sectors, such as the construction industry, project risk and complexity affect project outcomes. In the construction industry, project managers had a tendency to underestimate discrete project task complexity, thus increasing risk in the project (Turskis et al., 2012). Association of risk related to complexity includes variance to address unknown complexity for accounting in EVM (Nazilli & Postavaru, 2012). Including a variance that accounts for unknown complexity or risk allows for more accurate forecasting and ultimately project success (Nazilli & Postavaru, 2012). Project managers in the defense industry have had similar tendencies as those in the construction industry (Narbaev & De Marco, 2013). As provided, alignment of risk comprehension to other areas of EVM is important for project management success.

Project risk is a key consideration related to project success. Programs constantly face the risk of large cost overruns and delays, along with the final product delivery that do not provide some of the planned requirements (Wnuk, Gorschek, & Zahda, 2013). The project may have unexpected scope deficiencies the project manager in not aware of in the project (Wnuk et al., 2013). Project managers require risk management because government leaders sometimes cancel programs before completion because a program exceeds cost parameters, fails schedule goals, or misses performance requirements (Shah, 2014; Uzzafer, 2013). Project managers should consider the integration of risk management associated with the WBS (Shah, 2014). Project managers accounting for risk relative to the specific parts of a project should identify areas that may require more attention or additional resources (Shah, 2014). While EVM is useful in showing areas that are underperforming relative to cost and schedule goals, Shah (2014) found in his study that without the incorporation of a risk management program, project managers did not always meet goals by using EVM without other management methods. Project managers can find EVM helpful in that a predictive value based on accomplished performance might be determined. Project managers should realize EVM cannot help them account for unplanned developments or risks by itself (Shah, 2014). Risk management use by project managers planned with EVM use can help lead to more successful project outcomes.

Project managers that pair EVM with the consideration of risk and project focus can support successful projects. While EVM is predictive based on past work accomplished, risk management, when used synergistically, is flexible enough to account

for future issues (Kwak & Anbari, 2012; Shah, 2014). EVM is the *look backward* for a project manager, while risk management is the *look forward* on a project (Shah, 2014). Plummer (2010) showed that EVM use on IT programs was extremely helpful in looking at what caused the project problems, but found that management skill came from using the knowledge from the EVM use to address future risks. Risk management is the ability by a project manager to understand what potential problems there are and then apply the knowledge by using methods such as EVM (Shah, 2014). Findings from studies about project management success have indicated that the earlier a potential problem is identified, the more likely the problem can be avoided (William, Klakegg, Walker, Andersen, & Magnussen, 2012). Incorporating standard project management techniques such as project review with leadership, progress reviews, and benchmarking combined with EVM use and risk management increase the likelihood of goal accomplishment (William et al., 2012). Risk management and EVM use applied together could offer defense business contractor leaders a useful strategy for cost and schedule goal accomplishment.

Leadership Style and EVM Use

The leadership approach a project manager uses can affect project outcomes. Defense business contractor leaders and project managers have different perspectives relative to project management and goal accomplishment (Andersen, 2016). These different perspectives come from the reality of the individual project manager (Andersen, 2016). While no particular perspective is correct, practices and tools exist that assist project managers in goal accomplishment. Data indicates, though, that project success is

proportional to leadership participation across the project (Unger, Kock, Gemünden, & Jonas, 2012). Organizational leaders establish a sustained program management culture that fits the structure of the organization with a focus on success as defined by the organization and leadership (Acebes et al., 2013). Different leadership styles influence project success, including transformational leadership with the recognition of change for success (Boonstra, 2013). An organization that utilizes learning with leaders applying transformational leadership has leaders that understand learning and changing is important in the organization and affects success of the organization (Boonstra, 2013). Leadership that recognizes tools or methods for success that may be new to the organization can propel an organization forward (Boonstra, 2013). Leadership style used by organizational leaders can have more impact on projects than project managers contemplate.

One methodology or practice that project leaders use and learn from is EVM as a tool for project management. At the onset of a project, project managers establish a schedule and cost baseline (Colin et al., 2015). This baseline creation usually occurs first as unconstrained by resources and then resource alignment takes place (Colin et al., 2015). The resource alignment can help project managers identify problems such as with schedule and resource assignment (Colin et al., 2015). Defense contractor business leaders provide emphasis in a project through application of resources (Kerzner, 2013). Long-term business success is affected with the application of resources to strategy and mission priorities followed with alignment to leadership goals (Kerzner, 2013).

If project or program alignment and strategic initiatives do not exist, they can result in negative organizational outcomes. Without program and strategy alignment, there is a waste of resources and a loss of focus throughout the company (Kerzner, 2013). EVM use by project managers highlights where resource loss happened (Chen, 2014). If an organization is unclear where to emphasize effort, a disjointed effect can take place and leadership should be able to recognize this (Yang, Huang, & Hsu, 2014). An organization that follows numerous directions pulls apart (Kerzner, 2013). Frustration can mount with individuals in the organization when prioritization is nebulous (Kerzner, 2013). Projects fail for many reasons including poor leadership and poor coordination across the project team (Acebes et al., 2014). Empowerment within the organization for the project team to meet mission and strategy goals is also a key to success and, without it; a project failure is likely to happen (Sheffield & Lemétayer, 2013). Leadership that attains a fit between project management activities and strategy along with interrelationship between using the appropriate management methods offers the best opportunity for success (Acebes, 2014).

The project schedule is one of the three pillars a project manager focuses on and schedule fluctuation can negatively disturb project outcomes. Schedule disruptions are one of the most significant issues a project manager faces and EVM helps monitor and identify those issues (Colin et al., 2015). With identification of schedule disruptions early, project leaders have more opportunity to correct schedule deviations, thus more closely following the original baseline (Colin et al., 2015). Project leaders influence project success with the leadership style and the methodology employed on the project

(Young & Poon, 2013). Defense contractor business leaders that recognize areas that required focus could apply emphasis based on what they have learned from EVM.

EVM data shown with metrics can help guide project manager focus. EVM generated metrics, that through interpretation, signal areas where corrective actions are necessary (Colin & Vanhoucke, 2015). EVM use by project managers supports the three crucial phases of a project's life cycle: creation of a baseline schedule, risk analysis of the schedule, and project control (Wauters & Vanhoucke, 2014). The metrics gained from EVM may not be intuitive for a project manager and could impede project management progress and improvement (Colin & Vanhoucke, 2015). With unintuitive data, decision making by project managers from EVM use can become reliant on other factors such as experience or anecdotal information (Colin & Vanhoucke, 2015). Project managers in different industries including the defense and construction industry have implemented statistical process controls that improve EVM use (Colin & Vanhoucke, 2015). Since the 1960s, project managers have used EVM as a consolidated approach (Colin & Vanhoucke, 2015). EVM improvement in broad terms has not propagated across a large swath of the project management discipline (Colin & Vanhoucke, 2015). Clear and useful information from EVM use can help the project manager's goals.

Project managers in different business sectors use EVM to improve project outcomes. EVM is the global project management standard for project managers that captures scope, cost, and schedule (Czemplik, 2014). EVM use by project managers allows the project managers to collect values such as Actual Cost of Work Performed (ACWP), Budgeted Cost of Work Performed (BCWP), and Budgeted Cost of Work

Scheduled (BCWS) (Czemplik, 2014). As Colin & Vanhoucke (2015) identified, these values are not always intuitive for corrective planning. Other managerial instruments, when paired with EVM, help clarify the EVM methodology for project management improvement (Czemplik, 2014). These instruments include the cost plan and a breakdown of lump sum prices that help limit Cost Variance (CV) by providing knowledge of the data captured by EVM to project managers (Czemplik, 2014). Project managers in the construction industry have proven that use of the additional tools paired with EVM has improved construction project completion (Czemplik, 2014). While corrective action in a project may not be intuitive, my research showed EVM could help.

EVM can be useful with some of the different disciplines used by project managers. The systems engineering (SE) discipline helps project managers identify problem management as part of a SE process (Olson et al., 2012). While all project managers may not agree with the perspective of problem management as part of the engineering discipline as Andersen (2016) pointed out, project managers have different perspectives. Ultimately, the project manager is responsible for all aspects of the project including problem management. EVM is primarily for identification of existing problems for the project manager and, when paired with risk management, the use of EVM can aid in the forecasting of future problems (Shah, 2014). The application of EVM by project managers helps identify opportunities for project improvement and all of these areas were available for review with EVM use (Olson et al., 2012).

The opportunity management process is just as important as the problem management process in the SE discipline. The ability to forecast opportunity for cost and

schedule savings that improve cost and schedule variance enhances project outcomes (Olson et al., 2012). Communicating both problems and opportunities identified with EVM supports project success by project managers (Farok & Garcia, 2015). System engineering personnel could benefit from EVM, but like all members of the project team, those individuals should communicate across the entire team.

Communication of issues and ideas is important to a project manager and all aspects of the project. While EVM is a valuable tool, the ability to communicate by the project manager by what was collected with EVM metrics is a vital leadership technique (Farok & Garcia, 2015). Capturing data from EVM meets the definition of a hard skill for a project manager (Farok & Garcia, 2015). Leaders with the ability to communicate aligns more as a soft skill (Farok & Garcia, 2015). While EVM use provides data to project leaders that points to areas such as problems and opportunities previously identified, if the entire project team is not aware of these issues, adjustment do not occur (Farok & Garcia, 2015). The ability for goal alignment by project managers based on data from EVM thru communication is key (Farok & Garcia, 2015). Project teams require the continual communication across all disciplines, especially since EVM is a process and not an event (Farok & Garcia, 2015). Researchers have shown communication improves the overall welfare of employees (Hussein, 2015). Communication across all disciplines on the project team supports EVM use and improvement by project managers.

Project managers should create an environment that facilitates EVM use. Easy integration of EVM into the project decision support system is a very important process

related to project success (Vanhoucke & Colin, 2016). EVM use by project managers supports top-level WBS analysis and with an analytical review, project managers can focus an approach on discreet work packages (Vanhoucke & Colin, 2016). Vanhoucke and Colin (2016) presented that when a top-level WBS review happened, the review provided a bottom-level detailed insight with multivariate regression techniques. The most successful way to do this review was through the longest path (LP) analysis similar to critical path review (Vanhoucke & Colin, 2016). The critical path is the events and processes that occur for project completion regardless of value-added but noncritical path items (Vanhoucke & Colin, 2016). Project managers using the LP approach consider the longest path to project completion with serial projects that are optimized (Vanhoucke & Colin, 2016). The researchers Vanhoucke and Colin showed that EVM application worked better in serial projects than in parallel projects. The division of schedule and cost is difficult in parallel projects that require subjective resource alignment that skews EVM outcomes (Vanhoucke & Colin, 2016). The Vanhouke and Colin experiment tested the theory with extensive computational experimentation. The results showed that the most successful projects, as far as baseline cost and schedule alignment, used some variant of the LP method (Vanhoucke & Colin, 2016). The LP method connected with known project activity, when understood at each review period across the entire project, provided the best results for project managers (Vanhoucke & Colin, 2016). The Vanhouke and Colin results aligned with what Lenfle (2014) discovered in a case study regarding the Sidewinder missile. Comprehension of the required tasks across all requirements allowed delivery of an air-to-air missile that overcame scope, cost, and

schedule issues for delivery of a very useful weapon system (Lenfle, 2014). The LP method seems to have useful application and defense business contractor leaders should consider the LP method for use.

Project managers in different organizations define project success differently. While project success definition was dissimilar for different project managers in different organizations, the overall project methodology used in the organization was very influential in the project success (Joslin & Müller, 2015). EVM use and the application of results come under the overall Project Management Methodologies (PMM), a review utilized for project completion by project managers (Joslin & Müller, 2015). Much of the PMM determination comes from whether a company uses standardized PMM approaches or customizes the PMM (Joslin & Müller, 2015). While consideration and use of EVM is a standard approach by project managers, or as Czemplik (2014) identified as a global standard, success comes from adaptation to meet specific goals. A project is a unique effort with unique required outcome (Wysocki, 2014). Since a project is unique, modification of standard processes by project managers against the distinctive circumstances offers the best chance for success.

While EVM can help improve project outcomes, project managers should consider what projects are undertaken. While tools such as EVM exist that can help facilitate project success, one of the most crucial factors is selection of the right projects (Kaiser, El Arbi, & Ahlemann, 2015). Selection of projects aligned with business goals is a risk management technique itself (Kaiser et al., 2015). When projects are selected that do not align with company goals, the leaders on those projects make resource use

inefficient and ultimately support the demise of a company (Kaiser et al., 2015). Selection of projects by leaders that meet company goals and then the use of appropriate EVM tools increase a business's competitive edge and the success of the company.

Summary of the Literature Findings

While a review of both quantitative and qualitative current studies occurred as part of the literature review, the majority of studies considered were quantitative. Since the majority of EVM studies were quantitative, completion of a qualitative study was useful because multiple methods supported triangulation, which is key in social science research (Marshall & Rossman, 2016). A researcher doing a qualitative study allows for rich data collection where both planned and unplanned responses collections occurs through the research (Brinkmann & Kvale, 2014). The current literature failed to address EVM strategy for use by defense business contractor leaders that can improve cost and schedule outcome goals. Interviews allowed open-ended responses that surveys used in quantitative research does not capture (Finley, 2014). The literature review serves as the substance upon which the researcher gains a comprehension of the subject matter, addresses relevant research to the research question, creates interview questions, and ultimately establishes credibility (Marshall & Rossman, 2016).

The conceptual theory of earned time provided the encompassing standpoint by which to review the literature as related to the research question. EVM use in the defense industry is rooted in earned time and built upon to the current EVM methodology. EVM use transpires to identify deviations from a project baseline but EVM use still reflects the original concept from earned time that work has value in both time and cost. My review

of EVM literature of current studies showed that strategies exist related to improving PVs and ultimately EVM accuracy, which improve a project manager's ability to accomplish an effort. The research reviewed showed that an issue exists that project managers in the defense industry are not using these strategies. In addition, I determined some research gaps are present in current research in proving EVM more beneficial to meeting EAC for cost and schedule bounds as opposed to other means. An example of this was that subjective input from experience improved EVM outcomes as well (Chen, 2014). What researchers did show was with the improvement of PVs, EVM accuracy improved (Chen, 2014). The review of existing studies showed improvement in meeting EAC goals with EVM, but did not show greater success than against areas such as expert opinion (Chen, 2014). The studies reviewed supported EVM use and the increase in project management success with PV improvement.

In the interview and data review portion of this study, I ascertain what EVM strategies defense contractor business leaders have demonstrated that helped improve project management cost and schedule outcomes. A review of the literature showed that determining a strategy for EVM use with improvement in the PV and EVM value for use is important. Researchers showed a direct correlation between measurable project management success and EVM strategy use (Chen, 2014; Gershon, 2013).

This review of relevant literature showed that effective EVM use could improve project management outcomes. EVM is a tool that with use provided information against a pre-determined baseline based on scope, cost, and schedule. Using EVM supported the three phases of project management including the creation of the baseline, risk

assessment, and project control (Wauters & Vanhoucke, 2014). Different EVM methods exist but research showed the most effective techniques are ones such as the LP method (Vanhoucke & Colin, 2016). Project managers that use the LP method account for tasks provided a comprehension across the entire project team of the effort (Vanhoucke & Colin, 2016).

EVM usage provides information against a predetermined baseline based on project knowledge. There are different EVM methods for use but understanding the scope, cost, and schedule of the project before choosing the EVM method is key. The deterministic and probabilistic methods are both useful, but more important is the EWS that comes from the data. These EWS allow a defense project manager the ability to address project issues early and potentially correct the problems.

While some EVM strategies exist, defense contractor business leaders should understand how to utilize them. This review of relevant literature showed that project managers in the defense industry were not using effective EVM strategies. In addition, this review of relevant literature provided that with a solid understanding of scope, cost, and schedule of a project, EVM accuracy improves. Alignment with the WBS also provides value to project managers and improves EVM use. Risk is an important area many times overlooked, but consideration is useful and improves project success when accounted for. Complexity is a factor in project management success as well.

Risk management, tied to the problem management process when used with EVM use, is key to success as well. Project managers using SE utilized problem management but risk scope across the entire project fell to the project management lead. One of the

key risk management techniques for a company is selection of the right projects (Kaiser et al., 2015). When a company selects the right projects, the resources for that project align with overall company goals.

My review of the literature included a comparison of articles against the conceptual theory as well as a grouping of the articles with similar themes. The themes that were prevalent in the literature were (a) improvement of EVM values helped overall EVM methodology, (b) consider EVM use a skill set, (c) consider risk management and EVM use together, and (d) EVM supported effective leadership style. As Yin (2014) pointed out, theme review from the literature review helps support cross-validation of data. Continual review of the literature occurred during the study for new understandings and conceptual support. While EVM methods exist, defense project managers should understand how to utilize them. Researchers such as Kwak and Anabari (2012) showed that an issue exists that project managers in the defense industry are not applying EVM techniques. The analysis showed that effective EVM methods exist for improving EVM, which supports the project manager skill set.

Transition

Section 1 included the business problem, the central research question, study purpose, interview questions, and a literature review. The review of the literature supported the foundational conceptual concept of earned time theory as well as providing a historical context. As reflected throughout the literature review, significant research transpired related to EVM and the impact on project accomplishment. The provided assumptions, limitations, and delimitations helped establish boundaries for the study. I

presented a description of the significance of the study and the implications for social change. The significance of the study and social change discussion supported the overall goal of providing demonstrated EVM strategy that could help improve cost and schedule outcomes in the defense industry.

Section 2 contains a restatement of the purpose, a description of the study method and design, and a description of population and sampling. This section also includes an explanation of the process for ethical research, an outline of the interview process, the data collection process, planned methods for analyzing the data, and information regarding the application of ethical research methods. The section concludes with a description of the validity and reliability in the study so that support of dependability, credibility, transferability, and confirmability occurred. Section 3 includes the study themes and findings, application to professional practice, and implications for positive social change. A description of recommendations for action and future studies and reflections are in this section. This section ends with the study conclusions.

Section 2: The Project

This section includes a description of the method and design of the study, as well as the rationale for choosing each. Section 2 also contains the role of the researcher and a description of the participants. Included in Section 2 are descriptions of the ethical actions that supported the research. The details regarding the data collection procedures, data analysis techniques, and reliability and validity for the data are present as well. Section 2 also includes the description and preparation for the research.

Purpose Statement

The purpose of this qualitative multiple case study was to explore EVM strategies that Washington, D.C. area defense contractor business leaders were using to improve cost and schedule goal accomplishment. The population included defense contractor business leaders who are vice presidents, directors, supervisors, and program managers working at three defense companies in the Washington, D.C. area. Adjustment of the exact number of participants occurred based on when data saturation occurred. These defense contractor business leaders work for defense-focused companies and have demonstrated successful EVM strategy use on defense programs. The findings from this study could enable social change because defense business leaders could use additional resources to develop less harmful products that use less fuel, create less pollution, or use less environmentally toxic materials. When projects fell behind goals, project managers often deprioritized environmental improvements (Martinez-del-Rio & Céspedes-Lorente, 2014). The deprioritization of environmental improvements was due to the focus on returning the project back to baseline goals; however, with implementation of an

effective EVM strategy, this deprioritization could be avoided (Martinez-del-Rio & Céspedes-Lorente, 2014).

Role of the Researcher

I gathered reliable and valid data related to EVM strategies defense contractor business leaders have used to improve defense project cost and schedule outcomes. In qualitative research, the researcher is usually the primary collector of data (Marshall & Rossman, 2016). Qualitative research includes organizing and interpreting the data, which is the responsibility of the researcher (Marshall & Rossman, 2016). Experience with EVM, as well as interaction with defense contractor business leaders, allowed me to identify themes from the data. As a program manager for government military systems for the last 20 years, I have used EVM and have observed EVM use in the defense industry. This direct interaction with defense contractor business leaders on successful and unsuccessful defense projects in terms of cost and schedule outcomes allowed me to gain a deep understanding of EVM and the context of this study.

Participants need to understand the researcher's role and what expectations to have during and after the study (Corbin & Strauss, 2014). I completed the mandatory ethics training required for doctoral research that came from the Belmont Report (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research [NCPHSBBR], 1979). Continual review of ethical guidelines occurred throughout the study to ensure compliance. Each participant received a description of the researcher's and the participant's roles prior to the interviews. Participants received the reasoning for conducting the study, along with a description of

potential applications of the study results for defense contractor business leaders. To ensure the ethical foundation of the study, all participants received the interview protocol (see Appendix A) that defined the systematic process for the interview (Marshall & Rossman, 2016; Patton, 2015). By following the same steps throughout each interview, the data collection process is consistent (Patton, 2015). Enhanced dependability occurs when procedures are consistent (Finley, 2014). Adjustment to the role as researcher should occur as necessary throughout the process to support the research goals (Patton, 2015). While I considered adjusting my role if necessary, no change was necessary for the study.

I provided context as to the focus of the study and the potential benefits to the business contractor business leaders, including a description of Walden University's mission of social change. By providing the participants with a description of the researcher role and the interview protocol, the researcher promotes trusting relationships that encourage cooperation and engagement (Corbin & Strauss, 2014; Finley, 2014, Marshall & Rossman, 2016). Trust and rapport allow for a more robust and beneficial study (Anyan, 2013).

As part of the ethical foundation, I did not use participants whom I have worked with in any type of supervisory role or other direct influence relationship. Brinkmann and Kvale (2014) stated that is important not to have a supervisory relationship with participants. Although the participants were likely aware of this type of research in their positions as defense business contractor leaders, it was important to limit their concerns with the interview and study process. Ethical diligence is key in qualitative research

(Marshall & Rossman, 2016). I followed the procedures established by the Walden Institutional Review Board (IRB) throughout the study.

Because I have extensive experience with EVM use and observation of EVM use by defense contractor business leaders, I strived to mitigate personal bias. One of the primary roles of the researcher is to mitigate bias as much as possible within a study (Patton, 2015). Mitigating unintentional bias from a study is difficult because bias remains part of the human psyche (Finley, 2014; Patton, 2015). Emotion and human connection promote a deeper rapport in qualitative research, but bias could undermine objectivity (Finley, 2014). Bracketing is setting aside personal opinions and experiences and a process for use within a research study (Tuohy et al., 2013). While consensus on the bracketing method is limited among qualitative researchers (Tuohy et al., 2013), I identified positive and negative opinions and worked to limit those influences. By capturing a listing of my biases prior to starting my research, a working list existed to use when reviewing data. The challenge with using bracketing was that some experiences were helpful to the research. I used member checking as part of data collection to ensure accurate data collection. Member checking provides additional transparency in the process, which enhances the credibility and validity of research studies (Marshall & Rossman, 2016; Patton, 2015).

As the researcher, I was the principal party responsible for adherence to the interview procedures. As Brinkmann and Kvale (2014) pointed out, another mechanism for mitigating bias in a qualitative study is adherence to interview protocol. During the interviews, interview questioning happened with avoidance of additional comments that

might have swayed the participants' responses. I attempted to maintain neutral and limited body language.

Participants

The pool of candidates was made up of defense business contractor leaders with demonstrated EVM strategy use in the Washington, D.C. area. I selected participants who had appropriate experience regarding EVM strategy (Brakewood & Poldrack, 2013).

Eligibility Criteria

All participants were defense contractor business leaders who had demonstrated use of EVM strategy in improving cost and schedule outcomes. The participants included defense contractor business leaders such as vice presidents, directors, supervisors, and program managers working at three defense companies in the Washington, D.C. area. All participants were full time employees in the defense industry. I did not include the entire population of all defense business contractor leaders with demonstrated EVM use, because case studies do not have to include entire populations for value (Yin, 2014). Including the entire population was not a goal of this case study. A sample of defense business contractor leaders from the Washington, D.C. area was appropriate for the study.

The use of a sampling technique is important to gathering adequate data from a pool of participants. In a case study, participant selection includes specific criteria related to the purpose for appropriate sampling technique (Patton, 2015). Purposeful sampling provides a way to identify an appropriate group for a study (Byung-Cheol & Seong-Jin, 2015). The focus of my research was successful demonstrated EVM strategy

use from defense business contractor leaders. Demographic factors such as age, gender, and educational background did not influence the participant selection. Selection of participants according to the eligibility requirements strengthened the credibility and validity of the study.

Accessing Participants

I assessed the participants using the eligibility criteria. In small participant pools, it is important to maintain confidentiality, which is an underlying ethical consideration in a case study (Yin, 2014). I did not solicit participants from my workplace in order to reduce bias and maintain the confidentiality of participants.

Several avenues existed for locating potential participants. These included advertising in local Washington, D.C. newspapers and magazines, using flyers, advertising online through professional project management websites, or reaching out directly to defense business contractor companies and asking for participation. Recent qualitative doctoral studies at Walden indicated that using local newspapers and magazines, as well as flyers, were not helpful (Izard-Carroll, 2016). Online advertising could have had the same limited effect. The goal was to find individuals who met the eligibility criteria and were knowledgeable (Brinkmann & Kvale, 2014) in EVM strategy use in the defense industry. Reaching out directly to defense business contractor company personnel through mutual acquaintances presented the most effective method for soliciting participants.

I relied on a relationship between the researcher and participant as part of this qualitative research. An empathetic relationship, in which the participant believes the

researcher relates to and understands the participant's experience, provides more useful data for the research (Finlay, 2014). The quality of data derives from the rapport between the researcher and the participant and provides a richer and better response to the research questions (Finlay, 2014). Having a common experience increases the sense of empathy and increases the researcher's comprehension of the participant input (Patton, 2015). The rapport between the researcher and participant also increases comfort and reduces inhibition, which could encourage more thorough participant responses (Brinkmann & Kvale, 2014). When participants believe they are helping solve a problem, they are also more likely to contribute (Finlay 2014; Patton, 2015).

Interacting with participants prior to the study can build rapport. Dasgupta (2015) indicated that it was useful to meet in advance of participant interviews to build a familiarity that supports a deeper relationship between the researcher and participant. I did not meet with participants in advance of the formal interview due to coordination and time constraints. The participants had the interview questions in advance of the scheduled interview and were able to discuss any concerns with me via telephone or email. A balance between making myself available and approachable but nonintrusive was important for the study.

Research Method and Design

There are three types of research methodologies for social science studies (Patton, 2015). The three types of research methodologies are qualitative, quantitative, and mixed method (Bernard, 2013). Selection of the research methodology relates to the research question as well as the study purpose (Whiffin, Bailey, Ellis-Hill, & Jarrett, 2014). Based

on my research question addressing EVM strategies to improve project cost and schedule goal accomplishment, the qualitative methodology was most appropriate for the study.

Research Method

I reviewed the three types of research methodology prior to starting my research. Qualitative research includes a focus on experiences in the world (Finlay, 2014; Patton, 2015). The qualitative researcher seeks meaning in the experience and usefulness from the experience (Patton, 2015; Yin, 2014). By using qualitative methodology, a researcher can review the business practices from the participant's perspective for insight into the experience and behavior (Weerawardena, Mort, Salunke, Knight, & Liesch, 2014). The focus for this study was to explore EVM strategies that Washington, D.C. area defense contractor business leaders used to improve cost and schedule goal accomplishment. As Yin (2014) described, strategy research aligns with qualititative methodology because it fits a *what* analysis. Because I analyzed strategy and conducted analysis, qualitative methodology was the most appropriate for my study.

Quantitative methodology was the second research method considered. Quantitative methodology includes analysis of variable relationships (Groeneveld et al., 2015). Quantitative research also includes a hypothesis related to the study; because I did not have a hypothesis, I did not use a quantitative methodology. Hypothesis testing includes a review of a claim for a variable in a population of the sample group (Smartt & Ferreira, 2014). The goal was for a deep review of experience through an interview, not hypothesis testing. For decades, quantitative methodology was the accepted approach for social science researchers because it was considered more rooted in the scientific method

(Bernard, 2013). Over time, qualitative research has become accepted as an adequate alternative (Bernard, 2013). Different techniques used in qualitative research have become more aligned with quantitative research due to methods such as surveys that have allowed a larger sample size than interviews alone (Anyan, 2013). Although much of the existing EVM research is quantitative in nature because of a focus on the relationship between the variables used in EVM, the quantitative approach lacks a focus on experience and use of EVM. The use of a qualitative methodology allowed me to focus on this gap in the literature.

The final type of research methodology considered was mixed methods. The third type of research methodology, mixed methods, combined both qualitative and quantitative approaches (Christ, 2013). A significant issue with mixed methods is that the data collection can become unmanageable for a single study (Christ, 2013). However, mixed-methods methodology can support triangulation because both types of methods are available for use (Christ, 2013). As indicated in the quantitative discussion, I did not use hypothesis testing in this study. Without hypothesis testing, a mixed-methods approach was not appropriate. My review of EVM strategy using a qualitative approach could support a deeper understanding of EVM research when paired with findings from quantitative studies.

Research Design

A qualitative multiple case study design was best suited for my study to explore EVM strategies leaders were using to improve cost and schedule goal accomplishment. A case study was appropriate because in a case study, behavioral control is not required

and it did not occur with this study (Yin, 2014). My focus was a review of experience with EVM and demonstrated success with EVM in improving cost and schedule outcomes. A case study requires a number of interviews to gather data to create themes related to the research question (Patton, 2015). In a qualitative case study with interviews, data saturation occurs when participants cease to offer further insight into the research question (Brinkmann & Kvale, 2014). With the use of interviews, data saturation or redundancy sampling is not predictable since the participants are independent (Patton, 2015). While I had planned for seven interviews, I adjusted the number of participants to five for alignment with data saturation related to the research question. Data saturation occurs when no new data or themes develop from the research (Fusch & Ness, 2015) and this transpired with five participants.

Several alternative designs exist in addition to a case study. These designs are acceptable approaches in qualitative research. Determination of the design, similar to determination of the methodology, relates to the research question and the purpose of the study (Yin, 2014). I considered a phenomenological design that focused on studying the lived experiences of the selected participants (Khan, 2014). A researcher that uses phenomenological design highlights a phenomenon multiple people have experienced or shared (Khan, 2014). By using phenomenological research, a researcher can review a unique phenomenon and focus on the experience from a participant perspective as opposed to the researcher perspective (Patton, 2015). Because EVM use is not a unique experience and a focus on the participant perspective was not a study goal, the phenomenological design was not selected.

Another qualitative design considered was the ethnographic design. Similar to a case study, the ethnographic design uses interviews for review into the research question, but focuses on a culture in a group versus individual experiences (Corbin & Strauss, 2014). An ethnographic design would have required the observation of the group and group experiences (Yin, 2014), but that was not the goal with my study. EVM use and strategy development from a group's cultural perspective was not required because the goal was on demonstrated EVM use that has already occurred. I did not select ethnographic design due to these factors.

The final qualitative research design considered was narrative design. Narrative design is the use of participant story telling for analysis into the area under review (Khan, 2014). EVM use relates to strategy and improvement into cost and schedule outcomes and does not require a narrative story. Narrative design allows the researcher the ability to study the entire process but requires extensive time for consideration of each step (Marshall & Rossman, 2016). The study focus was on EVM strategy related to cost and schedule improvements with demonstrated use and did not require consideration of each step. For these reasons, narrative design was not appropriate.

A case study design best captured the goal of my research. While each of the other three designs considered could have provided a valuable research design for qualitative methodology, these designs did not seem as appropriate. Phenomenological, ethnographical, and narrative design do not align as well as a case study with a *what* analysis (Yin, 2014), and this was why a case study was best. A unique aspect of a case study is the use of other studies and data in a more open fashion as opposed to the other

designs because case study results can be more transferable (Patton, 2015). The exploration into demonstrated EVM strategy use by defense contractor business leaders best supported a multivariate case study. I used a multivariate case study for the research for these reasons.

Population and Sampling

The study population selected is an important aspect of the research. Selecting the appropriate study population is a key aspect of qualitative research (Marshall & Rossman, 2016). Researchers using qualitative research ensure credibility with appropriate population and sampling decisions (Patton, 2015). A goal for a researcher is for both population and sampling decisions to be transparent and understandable (Bernard, 2013). The collective decisions made by the researcher, including population and sampling, support the overall study credibility and validity while building a stronger analysis with clear and supportable decisions.

Population

The sample population was defense business contractor leaders employed in the Washington, D.C. area. These individuals were full time employees and were stable workforce members of their respective defense contractor companies. With such a large number of defense businesses in the Washington, D.C. area, the available population was adequate for the research. Since I currently live in the Washington, D.C. area, in person interviewing was the best approach to use as opposed to such techniques as phone interviews. The sample population included defense business contractor leaders that

demonstrated use of EVM for improvement in meeting cost and schedule goals for projects.

Sampling

Numerous sampling methods exist that support qualitative research and include purposeful, census, convenience, quota, random, and snowball (Emerson, 2015). For this research, I selected purposeful (also known as purposive) sampling based on the research question and established parameters. Purposeful sampling is the selection of research participants based on the established criteria and the participant's ability to answer the interview questions (Patton, 2015). Purposeful sampling is one of the most common sampling techniques as it allows gathering a pool of participants and focus on the research question (Palinkas et al., 2013). Purposeful sampling use allows extensive data collection and requires fewer resources than other sampling techniques (Palinkas et al., 2013). The one identified research weaknesses was that purposeful sampling did not necessarily lead to empirical transferability to the larger group of defense contractor business leaders (Palinkas et al., 2013). While five defense business contractor leaders in the Washington, D.C. area were interviewed on EVM strategy, additional EVM strategies may exist that were not reported.

Another sampling technique considered for use was random sampling. Random sampling usually contains a large sample size with the goal of gathering significantly relevant data (Palinkas et al, 2013). Random sampling is a popular method in quantitative studies because plotting on statistical curves is useful (Patton, 2015). Random sampling does require a significant number of hours for conducting the

interviews and for transcription, coding, and overall analysis against the research question; thus the time required can be a detriment in a limited research study (Emerson, 2015). As random sampling supports statistical analysis more thoroughly than other sampling methods and collected EVM strategy did not rely on statistical data, random sampling was inappropriate for use. When an entire population is available but can then be refined with unique parameters, purposeful sampling is more useful and less resource demanding (Emerson, 2015).

Snowball sampling is a technique that is useful in qualitative research. Snowball sampling is a sharing of the particular experience under consideration with other participants and includes gathering and analyzing themes (Emerson, 2015). The issue with snowball sampling is that the participants are open about their experiences, thus confidentiality is limited (Emerson, 2015). In this study, I considered this a problem as defense business contractor leaders did not want their respective companies or those they work with to know their true feelings about EVM use. A desire for confidentiality was especially true when EVM use was mandated and yet the defense business contractor leader held a different perspective than directed by the company leaders. While capturing demonstrated strategies, participants could have expressed EVM as ineffective as reflected in some of the literature reviewed, which would be counter to company leadership philosophy. Some researchers use snowball sampling to maximize the number of participants with empathy or shared experience (Perez, Nie, Arden, Radhu, & Ritvo, 2013), but this was not necessary for this research because a shared experience was not a focus. With the identified issues of a focus on shared experience and limited

confidentiality related to snowball sampling for this study, it was not an appropriate method for use.

I solicited participants from three Washington, D.C. defense companies while gathering participants in the order in which they responded to the participation request, as long as the individual met the eligibility requirements. Under purposeful sampling, random selection occurs that increases study credibility (Patton, 2015). As the pool of participants is gathered, selection of those from the eligible participants happens to eliminate preferred selection (Patton, 2015). By selecting participants this way, random selection happens under purposeful sampling for a technique known as purposeful random sampling (Palinkas et al., 2013). Random selection paired with purposeful sampling added additional credibility for my study and led me into selecting the participants who were necessary for useful results.

Sample Size

The sample size of the participant pool affects study results. Sample size in a qualitative research study is key to data saturation as the sample size determines data saturation (Fusch & Ness, 2015). Data saturation occurs with no new themes identified, or in this case, participants cease identification of new or additional insight into the research question (Palinkas et al., 2013). A sample size needs to be large enough for quality data gathering (Yin, 2014). Replication of the data reflects saturation, and the reason why more than one participant is normally necessary in qualitative research (Yin, 2014). Based on a review of some previous qualitative studies and data saturation,

occurrence in those studies, a pool of seven participants was the original number considered necessary for data saturation.

An initial dilemma for this research was the selection of the sample size. The selection of the sample size in a qualitative study in advance of the actual research has been an area of contention within the academic community (Patton, 2015). Quantitative researchers seek a sample size that offers statistically significant data but qualitative researchers are different in that sample size supports a deep review of the research question with rich data (Patton, 2015). I chose to use seven defense business contractor leaders as the initial sample size but adjusted to five defense business contractor leaders based on achievement of data saturation. Use of a sample size minimum of at least three participants ensued I had one participant from each of the respective defense companies.

I used an appropriate sample size to support EVM qualitative analysis. Determining sample size in advance is an acceptable procedure in qualitative studies and supports initial scoping (Palinkas et al., 2013). Qualitative studies of a similar nature support selection of the sample size based on when data saturation is achieved (Palinkas et al., 2013). Regardless of the sample size, achievement of data saturation is the goal and thus sample size varies based on the data from participants in a qualitative study (Brinkmann & Kvale, 2014). One of the gaps identified in the literature review was the limited number of EVM qualitative studies focused on strategy.

I selected a sample size of seven as the initial number of participants, and later I reduced the participants to five, and supported the balance between an adequate number of participants for data saturation and time management and resources. A sample size of

five participants supported theoretical transferability, or the collection of themes related to the theory or conceptual framework under consideration (Yin, 2014). Five participants from three defense companies in the Washington, D.C. area allowed a rich review of demonstrated EVM strategy. Demonstrated rigor, including substantive sample size determination, supported qualitative credibility (Bernard, 2013).

Interview Setting

The interview setting is an important aspect of a qualitative study. When using interviews, the interview setting provides a comfortable environment and sets the participants at ease (Finlay, 2014). A comfortable interview setting enhances rapport between the researcher and the participant (Marshall & Rossman, 2016). Interview locations that generally work best are ones in which the participant is familiar and comfortable, but also facilitates an interview with privacy (Marshall & Rossman, 2016). The plan was to use publicly available locations if the participants felt comfortable meeting in those locations and the privacy was suitable to allow confidentiality. A public library, a coffee shop, or even a public museum could have fit the need. A public library office was best suited for the interviews. Consideration of another location would have happened if the participants did not feel comfortable with using the public location. I worked with the participants to ensure an agreeable location was suitable for the interview. Consideration of only locations that did not adversely affect the credibility or validity of the study occurred (Marshall & Rossman, 2016).

While my preference was for an in-person interview and this was possible due to living in the Washington, D.C. area and with the participants also living in Washington,

D.C., an alternative was conducting phone interviews. With a phone interview, the participants could have chosen any suitable location for them, including their home. For phone interviews, the participants would have had the questions in advance, similar to an in-person interview. Interaction would have been limited with the participant to the interview questions. A negative effect of a phone interview is the inability to observe body and facial expressions (Brinkmann & Kvale, 2014). Other interview means existed with recent technology advancements such as FaceTime or even a Video Teleconference (VTC), but no plan existed to use those communication means. A VTC or other similar means would have allowed nonverbal cue observations but may not have been as convenient for the participant (Pearce, Thøgersen-Ntoumani, & Duda, 2014). I sought an interview location that provided a comfortable environment, facilitated a positive rapport with the participant, and ensured confidentiality as part of ethical research.

Ethical Research

Walden University has an IRB with the primary purpose of ensuring applicable law and academic regulations on studies using human subjects. Many universities use IRBs prior to conducting actual research, because the IRB must provide approval and concurrence that ethical research guidelines will be used (Klitzman, 2013). I used human subjects as the participants for the interviews and ensured that the principal guidelines of ethical research, of no harm to either the participant or researcher, happened (National Commission for the Protection of Human Subjects in Biomedical and Behavioral Research, 1979). Ethical research protects the rights of human subjects (Yin, 2014). No

research interviews for this study occurred after IRB approval. The IRB approval number for this study was 03-14-17-0541319.

As a prerequisite to participating in the study, the participants provided an email consent after review of the interview protocol (Appendix A). The interview protocol described the purpose of the study and eligibility requirements. The interview protocol contained a statement that participation was voluntary. While participants responded via email consent and initially agreed to participate, the participants understood they could withdraw from the study for any reason. The interview protocol included the statement that the participant could withdraw at any time by notifying me of that request. I reiterated at the onset of the interview that the participant might withdraw at any time.

The interview protocol included a confidentiality statement that the participant's identity remained confidential during the study and after publishing the results. While some researchers indicated monetary incentives could have increased participation in academic research (Klabunde, Willis, & Casalino, 2013), incentive use did not occur. Participants will receive a personal copy of the study and an executive summary including the results so they can read the outcome and impact of their respective participation.

I will retain the data collected in this study for the required five years in both hard copy and electronic form. After the five-year period, data destruction will occur following appropriate procedures for destruction of these types of academic research materials. Electronic data is stored in a password and encrypted location with only my access. Hard copy documents are stored in a file cabinet under lock and key.

Participants saw these protocols, as a description was part of the interview protocol document (Appendix A). The goal of both the electronic safekeeping and physical lock and key mechanisms is to ensure confidentiality of the participants' identities, a key concern of the research study (Brinkmann & Kvale, 2014).

The participants' names and organizations will remain confidential. The actual names of the participants and organizations were redacted and a letter and number system used instead. I created a participant and organization key, which helped confidentiality alignment for participants and organizations that will remain in the secure file. An example of this lettering and numbering system identified a participant as Participant 1 from Organization 3. An example of an acronym capturing this information is P1O3. The actual EVM strategies used by defense contractor business leaders were important, not the demographic discriminators, so there was limited necessity for alignment of actual participant names and companies. Contact information will remain in the locked file should it be necessary to contact the participants after the interview. The expectation of privacy and confidentiality remains a foundational expectation throughout the interview process and after the study is complete (Yin, 2014).

Data Collection Instruments

I acted as the primary collection instrument in this study. In qualitative research, the researcher normally serves as the primary data collection instrument (Bernard, 2013). I used in depth, semistructured interviews with open-ended questions for collection of useful data on EVM strategy. By using semistructured interviews, the participants responded to the established questions but had response flexibility because the questions

were open-ended (Yin, 2014). While most EVM studies were quantitative in nature, some researchers have used semistructured interviews for EVM review in a qualitative study (Ancosky, 2013).

Each participant received the interview protocol document (Appendix A) in advance of the interview. I provided the interview questions in advance of the interview so participants could have a level of comfort prior to the formal interview. The interview protocol document contained an explanation of the guidelines and protocols for ensuring ethical research technique use (Yin, 2014). In particular, the interview protocol document (Appendix A), had a description of human subject protection, data collection, and storage guidelines, along with safeguarding measures for confidentiality (Bernard, 2013).

Recording the interviews was part of the interview protocol. Recording an interview in a qualitative research study allows for accurate data collection and the ability for transcript review following the interview (Brinkmann & Kvale, 2014). Note taking took place during the interviews, which helped with later reviews (Houghton, Casey, Shaw, & Murphy, 2013). After the interviews, I used member checking as an accepted method for data validity. In a qualitative research study, member checking helps confirm the interview data (Marshall & Rossman, 2016). Member checking allows clarity of interpretation since different interpretations might have occurred during the interviews (Marshall & Rossman, 2016). Theme intelligibility and analysis support come from member checking (Patton, 2015). While all efforts to remove unintentional bias occurred, researcher bias can infiltrate the data through the interview process (Patton,

2015). Member checking helps mitigate that bias (Patton, 2015). Active participation from the researcher and each participant was an effective research method when using member checking for theme creation and mitigating bias (Patton, 2015).

As part of the data collection process, I informed the participants about member checking. Having the participants take part in member checking allowed for the support of data triangulation (Patton, 2015). Data triangulation is a review of the data across all of the sources of data for consistency of information (Marshall & Rossman, 2016). Data from the actual interviews, as well as other sources including available public documentation and data, supported data triangulation (Yin, 2014). The validity of the data with appropriate triangulation allows for the emergence of themes that can be used in future EVM strategy research.

Data Collection Technique

The principal data collection technique was semistructured interviews. A semistructured interview allowed an in depth analysis of EVM strategy with participants answering preestablished questions. While semistructured interviews have established questions, the format allows for open and free discussion (Yin, 2014). An alternative to semistructured in depth interviews was using focused interviews, which was another potential choice I had for this study. Focused interviews generally align to a more specific issue but problematically can induce more bias because the researcher focuses on supporting the data and conclusions by using the interviews (Yin, 2014). Bias could have occurred with semistructured interviews because using leading questions sometimes happens so remaining with the predetermined questions is important (Yin, 2014). A

structured interview might have been useful but because participant responses would have been close-ended, a structured interview would not have allowed as in depth an analysis required for analysis of EVM strategy.

Several other methods exist for data collection in qualitative studies. Many researchers of qualitative studies use a survey to gather a larger participant pool rather than using an interview method, which creates a more statistically valid result (Patton, 2015). An issue with surveys is that the individuals taking the survey do not clarify responses or answer additional in depth questions unless the survey is paired with another technique (Marshall & Rossman, 2016). With a strategy review focused on *what* analysis (Yin, 2014), a rich, detailed review is best supported with an in depth, semistructured interview.

I used a recording device to capture the complete interviews, as I was the principal data collection tool. A suitable recording device, an iPhone 6, supported the recording of the interviews. Recording the interviews helps ensure accuracy and later supports member checking (Brinkmann & Kvale, 2014). Writing down observations during the interview relative to the participant discussion assisted in obtaining further clarity. These observation notes helped when returning to the interview data after completing the interviews. Patton (2015) pointed out using observation notes is a helpful method when using semistructured interviews and serves as a second method of data collection when using interviews. An iPhone was not intrusive during the interview and a plan existed to have a backup device of a similar nature.

As part of the interview process, I annotated an accurate timeline of interview activities with each participant for further support of the data. The timeline is helpful in ensuring consistency of the process (Houghton et al., 2013). The capturing of the interview process along with observation notes supports data analysis through the entire qualitative process (Brinkmann & Kvale, 2014). It was important to note that while the plan was to take notes, note taking was a conscious effort so as not to distract the participant and impact rapport.

I did not conduct a pilot study in advance of the actual interviews. While a pilot study could have been useful in identifying issues early, a pilot study is not always necessary in qualitative research (Morin, 2013). A pilot study allows the development of consistency in the interview protocol that supports the actual study (Morin, 2013). A pilot study would have taken additional time and resources and consideration against the value of expending those resources is important (Morin, 2013). A pilot study would have also required IRB approval, just like the formal study, and could have excluded potential participants (Morin, 2013). Based on consideration of resources, my belief was defense business contractor leaders would not gain enough utility from a pilot study for this analysis into EVM strategy use and there would not useful information gained related to the process.

As part of the data collection process, an attempt occurred for consistency in the length of the interviews. For the participant's comfort, I strived to have an adequate length interview where the participant felt as though their participation had value, but not too long as to wear down the participant. Determining an adequate length of time for all

participants was difficult as all individuals have their own thresholds, but it appeared around 60 minutes was appropriate for the interviews. Bush (2016) indicated that 60 minutes allowed enough time for the face-to-face semistructured interviews without fatiguing the participant.

Member checking use supported the data collection process. Member checking allows consistency in theme creation from the interviews (Patton, 2015). Member checking supports consistency in interpretation of the data matched with the information the participant provides (Patton, 2015). I explained member checking to the participants, as some researchers had indicated member checking confused participants in the theme review (Houghton et al., 2013). Instead of using member checking, transcript review or peer debriefing could have taken place (Houghton et al., 2013). Transcript review and peer debriefing would have been labor intensive and would not have provided additional value over less labor intensive member checking. Transcript review requires the participant to review word for word the captured interview while peer debriefing uses an expert in the area of study who reviews the data (Fusch & Ness, 2015; Houghton et al., 2013). Member checking further supports data saturation with participants confirming identification no new themes after the interviews and the ability for replication with useful data collected (Fusch & Ness, 2015).

Data Organization Technique

The purpose of this qualitative multiple case study was to explore EVM strategies that Washington, D.C. area defense contractor business leaders were using to improve cost and schedule goal accomplishment. Semistructured face-to-face interviews

supported this research. A case study database is a useful tool for qualitative research (Yin, 2014). I used an encrypted database on a personal computer that was password protected for storage of the electronic data. A backup of the data on a password protected Universal Serial Bus (USB) drive was stored in a locked file cabinet along with the notebook used for notes. A notebook with personal notes relative to each respective interview helped with data interpretation and supported ensuring data saturation. I labeled each recording file with the participant and organization, as well as the date of the interview took place. An example of this was P1O22MAR2017 where P1 was the participant, O1 was the organization, and 22MAR2017 was the interview date. I was the only individual with access to the personal and organizational data that aligned with the coding system, and this helped ensure confidentially. It is important that the organizational system used supports cross checking and theme development support (Patton, 2015). Support of the reliability of the data came from member checking. All data will be stored under the secure means for 5 years. After 5 years, destruction of the data will transpire following qualitative research guidelines.

Data Analysis

Determination of themes was a significant aspect of my research. Qualitative data analysis includes identifying key themes and elements from the gathered data (Bernard, 2103). I initially used inductive analysis for determining patterns and themes. Inductive analysis is initial theme creation based on the initial review of research literature (Yin, 2014). Inductive analysis allowed me to identify prevalent themes from the data other than interviews, and I applied codes to patterns and themes in the data based on insight

and initial research. After the interviews were complete, the analysis was more deductive as themes developed from the actual interviews.

My plan was to use bracketing for identification of any preconceived opinions. Prior to research beginning, it was important to identify ways for bias mitigation (Bernard, 2013). Bracketing is determining bias that could influence the researcher study results and identifying the bias in advance for awareness (Bernard, 2013). I minimized bias transfer to the data collection by identifying any preconceived opinions and bracketing those opinions from influencing the data. Creation of the research question and interview questions reflected a neutral stance toward EVM strategy even with EVM familiarity during the last 20 years. Removing bias during the engagement with the participants allowed an open dialogue so that demonstrated EVM strategy by defense business contractor leaders with cost and schedule outcome improvements was collected.

Coding the data helped me collect similar themes from all of the interviews and develop core concepts (Marshall & Rossman, 2016). It was important that coding included themes related to the conceptual theory serving as the basis of this study, earned time. Coding is taking similar thoughts or ides from the interviews and company documentation and placing a code on similar inputs to facilitate analysis (Marshall & Rossman, 2016). I used NVivo after collection of the data to help code similar interview and document word groups and then I created codes to put those similar ideas together.

I used NVivo software after completing of all the interviews to assist in coding of the data. NVivo is a common software tool used in qualitative research because of the ease of use and the effectiveness in coding and theme development (Bush, 2016;

Marshall, 2015). The process started with labeling each interview as described in the data organization section and then importing the audio file into NVivo. NVivo has a transcription mode that can capture the entire interview and put it into a word document. The participants had the interview findings for use during member checking. The participants reviewed their respective interview findings for accuracy and did not provide any changes to the findings. Upon agreement of the findings, the participant approved the findings for use. NVivo supported my finding and assisted me in exploring the themes from the interviews regarding EVM strategy. NVivo supported my review of all of the data from different perspectives, as the coding was extensive and inclusive. Reviewing data from different viewpoints is horizontalization and supports study credibility (Corbin & Strauss, 2014).

I established credibility in this research with methodological triangulation. Methodological triangulation is a review of various data related to the research under consideration that derives from different collection methods (Patton, 2015). The data for review were archival in nature, collected from various studies on EVM and included both quantitative and qualitative research. I also reviewed public documentation from the organizations on EVM strategy but the information I used in the findings still supported confidentiality. Much of the supporting data for the methodological triangulation came from studies similar to those in the literature review. While triangulation included the use of internal and external documents, use of documents did not negatively affect confidentiality. Coding and synthesizing data from numerous sources supports study credibility (Yin, 2014). My use of NVivo supported data saturation and supported

credibility because NVivo helped me show no new data or themes developed through the interviews.

Reliability and Validity

Quantitative research relies on reliability and validity of data. The dependence on reliability and validity is the foundation of quantitative research because the data comes from statistical or numerical calculations (Yin, 2014). Qualitative research is different from quantitative research because it does not necessarily rely on variable relationships captured numerically, but rather on the depth and richness of the data collected related to the research question (Marshall & Rossman, 2016). Qualitative research aligns credibility, transferability, dependability, and confirmability with reliability and validity in quantitative studies (Marshall & Rossman, 2016). Quantitative data uses numerical values that have defined mechanisms for reliability and validity, while qualitative research uses accepted qualitative methods such as member checking and methodological triangulation (Burau & Andersen, 2014). The ability to replicate results mathematically in quantitative research supports reliability but with qualitative research the results from a semistructured interview are likely not repeatable but may support data saturation (Marshall & Rossman, 2016). Following well-defined qualitative measures support the credibility, transferability, dependability, and confirmability of a qualitative research study.

Reliability

It was important in my research that future researchers consider my results reliable. Reliability is the replication of results based on conformity of the process

(Patton, 2015). Results in qualitative research are likely not duplicative, as in quantitative research, but are reflective of the process (Marshall & Rossman, 2016). Dependability in qualitative research is similar to reliability and researchers address consistency and repeatability (Yilmaz, 2013). In advance of the interviews, I established a protocol and I used it for each of the planned interviews. Use of a standardized interview protocol is a type of reliability test because it is consistent (Yin, 2014). Recording the interviews supported accuracy of the information and supported dependability with the standardized protocol.

Dependability occurred in my research by following a standardized interview process that provided an audit trail and trustworthiness of the data. Iterative member checking further supports reliability and dependability by ensuring accuracy of the data and reflection of the messages the participant is seeking to relay (Fusch & Ness, 2015). Member checking further supported dependability because with method triangulation of the interviews and company documentation, there was rigor in the data collection. The use of archival documentation such as journals, further supported rigor in the data collection process (Marshall & Rossman, 2016). Confidentiality confirmation occurred with member checking because each participant had the opportunity to remove information that concerned them. Participants did not remove any information related to confidentiality. The use of NVivo further supports dependability because coding helps the researcher identify themes as an accepted qualitative practice (Houghton et al., 2013).

Another research aspect important to reliability is data saturation. Data saturation further supports reliability because no new data is collected and participants provide

redundant responses (Marshall & Rossman, 2016). Saturation reflects repetitive data and thus reflects that more than one participant who provided the same information and supports study dependability (Bernard, 2013). Data reliability validation happens with more than one source (Yin, 2014). Methodological triangulation further supports reliability because archival data use by a researcher helps confirm themes (Burau & Andersen, 2014).

Validity

Valid study results help a researcher authenticate a research effort. Validity in qualitative research relates to the credibility, transferability, and confirmability of the study (Patton, 2015). All three of these factors have a foundation in data saturation (Patton, 2015). Credibility in qualitative research ensures data reflects an accurate consideration of the participants' experiences (Bernard, 2013). Study credibility further supports trust in the findings and external party acceptance of the study findings (Kemparaj & Chavan, 2013). Member checking helps ensure credibility as each respective participant reviews the interview and ensures consistency and accuracy of message (Marshall & Rossman, 2016). Mitigation of bias with a means such as member checking ensures data saturation and further supports study credibility by having accurate information from multiple sources (Cope, 2014).

Methodological triangulation is another method for ensuring study credibility. Data collection occurs from more than one source with methodological triangulation (Burau & Andersen, 2014). With data collected from more than one source, data corroboration occurs for research use and if data is not available from more than one

source, use of the single source data should become a consideration for further use of the data (Burau & Andersen, 2014). I reviewed archival data on EVM strategy of both a quantitative and qualitative nature for this study. Note taking, along with the interviews is an additional data source and supports methodological triangulation in the study because data comes from more than one source (Houghton et al., 2013).

A key aspect of qualitative research is application to future research. Transferability relates to the study having application in similar research or context (Patton, 2015). A defined process that is repeatable is one of the underlying requirements for transferability (Bernard, 2013). The defined interview protocol and the data collection process for this study were present and available for use by future researchers. Transferability in qualitative research includes alignment to the theory under review, or analytic generalization (Yin, 2014). Analytic generalization allows the researcher to conduct an alternative research review of theory application and thought (Yin, 2014). Earned time theory and the associated review of the theory in this study were well defined and have potential for use by future EVM researchers. While future EVM researchers may not consider the exact research question analyzed for this study on EVM, the knowledge gained from this research should transfer well with related EVM studies.

Future researchers using my research can review the defined interview process for the study in entirety. Confirmability in qualitative research is the ability for a researcher to audit the research process so decisions and method within the study are understood (Houghton et al., 2013). A case study database was available that supported the entire process (Yin, 2014). Replication relates to confirmability and with a well-defined

process, replication supports results through methodological triangulation; confirmability was achieved (Marshall & Rossman, 2016).

Data saturation is a key component of valid qualitative research. A key requirement for qualitative validity is data saturation (Yin, 2014). Member checking occurs to ensure consistency between what the participants are trying to portray and what the researcher collected in the data. Coding and theme creation corroborate no new data or themes (Houghton et al., 2013). With a continuous review of the data, the themes related to EVM strategy use for improvement of cost and schedule outcomes became evident. With data saturation, I ensured no new themes developed from the study. While I selected an initial sample size of seven participants, I adjusted the sample size as necessary, until no new data or themes emerged from the interviews. Brinkmann and Kvale (2014) pointed out that another way to validate data saturation is through the member checking process because the researcher does not collect additional themes in the interviews.

Transition and Summary

My study goal was exploration into EVM strategies defense contractor business leaders were using to improve cost and schedule goal accomplishment. Section 1 included the problem, the central research question, study purpose, interview questions, and a literature review. My goal of section 2 was to describe this qualitative multiple case study and to address the study method and design, the population and sampling, ethical research, outline the interview process, the data collection process, and planned methods for analyzing the data. There was a description of how the study occurred with

the application of ethical research provided. The section concluded with a description of the validity and reliability with consideration of dependability, credibility, transferability, and confirmability in the study. Section 3 includes the study themes and findings, application to professional practice, and implications for positive social change. A description of recommendations for action and future studies and reflections are in this section. This section ends with study conclusions.

Section 3: Application to Professional Practice and Implications for Change

Introduction

The purpose of this qualitative multiple case study was to explore EVM strategies that Washington, D.C. area defense contractor business leaders were using for improved cost and schedule goal accomplishment. The most noteworthy finding was that leaders constantly verified a want or need for EVM data that could improve project outcomes. While the participants stated that EVM data was collected on a regular and recurring basis, the data were not used in a fashion that improved cost and schedule outcomes. The participants indicated that EVM strategy must exist at a high level within the organization but that the respective teams must understand that strategy and implement it in a manner that improves outcomes. The participants described that the individuals collecting and determining what to provide to the leaders must understand how the information they are providing the leaders can be used.

The participants described that EVM strategy had to include why data were needed, the relationships between that particular information, and how that data can be used to influence improved outcomes. All of the partcipants emphasized that data collection for the sake of collection was not helpful, and EVM strategy needed to account for a deeper use of EVM data as opposed to just data collection. Participants described that when EVM strategy was used, leader engagement was required to focus the impact from the data with the flexibility to adjust project team actions as the project life cycle progressed and issues highlighted from the EVM information changed. The participants

reported that ultimately they, as leaders, must understand what knowledge they have gained from EVM use, and how best to apply it to the respective project.

Presentation of the Findings

The principal research question for this study was: what EVM strategies do defense contractor business leaders use to improve project cost and schedule goal accomplishment? Data collection included semistructured interviews with member checking, along with a review of documentation from the businesses, interview notes, and archival data. I considered all of the data sources in compilation of the findings. My review of data sources took place to understand the EVM strategy defense leaders were using to improve cost and schedule goal accomplishment.

The interviews and business information on EVM, along with archival EVM information allowed me to triangulate the data methodologically. Methodological triangulation supported study credibility because more than one data collection source was used (Burau & Andersen, 2014). By using purposeful sampling for participants at a mutually agreed to location, pertinent information was collected.

Washington, D.C. was the geographical area that I focused on in this study. Interviews took place over a 10-day period and included five interviews. While the participants were aware they could have withdrawn at any time, no participant withdrew from the study. All participants had at least 10 years of experience with EVM. Four of the interviews lasted approximately 60 minutes and one interview lasted 75 minutes. I used member checking after the interviews to support study validity and to ensure that data saturation occurred. All five participants agreed to have the interview audio

recorded. At the completion of data collection, I used NVivo software to support the qualitative data analysis, store the data, organize, and help code the data.

Earned time theory was the conceptual framework for the study. Gilbert and Carey (1948) created earned time theory to assert the time for completion of a task has value. I used this conceptual framework to understand the underpinnings of EVM and business leader strategies for using EVM for cost and schedule goal accomplishment. The foundation of the conceptual framework of earned time supported the research and facilitated a deep review of the problem under consideration. My exploration into EVM strategy use happened by using earned time theory as the conceptual framework, and a review of the literature and interviews. The responses received from the participants correlated with earned time theory. The findings contain EVM strategies that the selected defense business contractor leaders used to improve cost and schedule project outcomes.

The data collection and coding process showed 445 coded statements and 26 unique nodes or groupings, from which I derived four main themes. The first main theme that I identified was that defense contractor business leaders wanted and sought out useful EVM data to improve cost and schedule goals. The second main theme that I identified was that there were essential EVM strategies that existed for leaders to use. The third main theme was that EVM use was important, but EVM was only one tool of many to use. The fourth main theme was that leadership engagement was essential to gain the most use from EVM data.

Some of the findings from my study confirm results from other EVM and business studies (Ancosky, 2013; Moy, 2016; Shah, 2014). Further, the results from this

study extend the body of knowledge related to EVM and EVM strategy use. While the main themes uncovered with this analysis aligned with the studies conducted by Ancosky (2013), Moy (2016), and Shah (2014), this review provided a deeper qualitative exploration than those previous studies. Consistent with the Plummer (2010) study, leaders sought out EVM data to improve outcomes. Chen's (2014) study contained similar findings to those of this study.

Theme two, that essential EVM strategies exist, was supported by the Vanhouke and Colin (2016) and Chen (2014) studies. The qualitative results from my study correlate to the Moy (2016) quantitative research and extended the discussion beyond a statistical and mathematical review. Acebes et al. (2014) reviewed basic EVM use and confirmed that there are EVM strategies that project leaders can use. A gap I identified in Moy's research was the lack of a deeper analysis of the EVM strategies available for use, as opposed to using a correction of the EVM variables (Chen, 2014).

The third theme identified, EVM is only one tool, aligned with the Acebes et al. (2013) and Batselier and Vanhoucke (2015) research. Shah (2014) further stated that EVM is only one tool and that consideration of risk management tied to EVM use should occur. Shah stated that while EVM use was helpful in meeting cost and schedule goals, other means to meet goals such as risk management were more useful when used with EVM. The Caron et al. (2012) study had similar findings in that experience paired with EVM, as opposed to EVM use alone was more beneficial. EVM use paired with another management method such as risk management was more beneficial than one technique used alone or not considering other cost and schedule mechanisms.

The fourth theme, leadership engagement is essential, did not occur in previous research, but was present in a direct discussion of leadership and EVM strategy use with participants. Previous researchers identified leadership engagement across an entire project tied directly to project success (Unger et al., 2012). Further, leaders recognized tools or methods for success that an organization could have used to help an organization succeed (Boonstra, 2013). Colin et al. (2015) pointed out that leadership alignment of resources and baseline creation by project leadership was important, but did not identify leadership engagement with EVM strategy.

The initial minimum population sample size was more than three participants so that a participant came from each respective organization. The planned sample size was initially seven leaders based on anticipated data saturation, but later reduced to five leaders as data saturation occurred with five participants. Achievement of data saturation is vital for study credibility (Fusch & Ness, 2015). The five interview participants provided a rich and in depth review of the topic under consideration. I was able to create an in depth list of themes and sub-themes from the interviews.

Main Theme One: EVM Data to Improve Outcomes

The first main theme was that defense business contractor leaders wanted and sought out useful EVM data for improvement of cost and schedule outcomes. Responses to interview questions two through eight supported this theme. The interview responses from all of the participants identified that defense business contractor leaders worked within their organizations to gather potentially helpful EVM data. The participants articulated a deep desire to meet or improve cost and schedule goals and if EVM data

could help with that, then they wanted that information. Participant two stated, "Of course I want EVM data, especially if it shows where I should focus the team to get better for cost and schedule goals." Interview response collection occurred and my documentation review found that main theme one had 142 mentions for a 31.91% response rate (see Table 2).

Table 2

Frequency of Main Theme One

Theme	*n*	Rate of Occurrence
EVM data to improve outcomes	142	31.91%

During the interviews, the participants further identified that they worked to encourage personnel in their organizations to understand the difference between the collection of EVM data and the actual usefulness of the data. These responses further supported main theme four. All five participants validated that they wanted and actively sought useful EVM data for the defense projects they were responsible for leading.

Company documentation reviewed for all three companies supported the theme in that the companies' leadership wanted EVM data for support of the decision making process. One issue that was unclear was whether the company leaders desired EVM data for the actual improvement of cost and schedule outcomes or because the government mandated EVM. The documentation data was at a higher level of company outcomes as opposed to individual leader needs.

Main Theme Two: Essential Strategies Exist

The second main theme was that essential EVM strategies existed for defense business contractor leaders to improve cost and schedule outcomes. Responses to interview questions 2, 3, 4, 5, and 9 supported the data for main theme two. Participant three said, "There are numerous EVM strategies, just figure out what is best for the project and the team to succeed." Interview responses and a review of company documentation reflected EVM strategy existence for leader use 126 times, representing 28.31% of all responses (see Table 3).

Table 3

Frequency of Main Theme Two

Theme	*n*	Rate of Occurrence
Essential strategies exist	126	28.31%

Four strategies appeared from the data collection including the interviews and business documents. Main theme two had a foundation from four subthemes, or EVM strategies. I used methodological triangulation to confirm the data from multiple sources. The four strategies were focused EVM use, comprehension of the data, addressing exposed issues, and continued monitoring of application (see Table 4). "First I understand the data, then I focus effort on the issues shown, and finally continue to see if the EVM data shows improvement" (P1). Refined leadership engagement with EVM use added information to the body of knowledge on EVM use.

Table 4

Frequency of Sub-themes under Main Theme Two

Theme	*n*	Rate of Occurrence
Focused EVM use	36	28.57%
Comprehension of the data	33	26.19%
Addressing exposed issues	30	23.80%
Continued monitoring of applications	27	21.42%

The findings in the second main theme reflected how valuable effective EVM strategy is for defense business contractor leaders to improve project cost and schedule outcomes. The strategies identified by the participants underpinned the conceptual framework of earned time because there is a need to understand that each project task had value in both cost and time. The use of EVM by these participants captured a baseline of the cost and schedule of each respective task and that understanding helped the business leaders apply effective strategies. The second main theme that effective EVM strategies existed was similar to what Shah (2014) presented.

The review of company documentation for all three companies supported that essential EVM strategy existed. There was a significant difference between the documentation in regard to the level of detail relative to EVM use and strategy. A review of company one documentation showed that consideration of EVM strategy by leaders at company one should happen and should help meet mandatory requirements. My analysis of documentation from company two and three showed that company two and three went

into deeper detail on EVM use as opposed to the EVM use documentation at company one. In company two, the authors of the documentation placed the onus on the leader to develop the strategy best suited for the project and reported that EVM strategy helped the company be successful. My review of company three documentation provided information on EVM strategy and identified strategies for success. All four of the subthemes identified through the interviews were present in the EVM documentation for company three.

Main Theme Three: EVM is only One Tool

The third main theme identified through the interviews and document review was that defense business contractor leaders thought EVM was only one tool for use. The participants and data provided EVM is a useful tool but added that numerous tools existed for affecting project cost and schedule outcomes. A participant noted, "EVM is a good tool but there are several methods or tools to use to get better project outcomes. The leader has to figure out what works best" (P5). Another participant stated, "EVM is good, but so are other things…pairing EVM with other tools is what has worked best for me" (P3). Responses to interview questions two through nine supported this main theme. This main theme had 90 participant and document statements for a 20.22% rate of occurrence (see Table 5).

Table 5

Frequency of Main Theme Three

Theme	*n*	Rate of Occurrence
EVM is only one tool	90	20.22%

Each of the five participants responded that their experience with EVM use was effective if used properly for positive impact on cost and schedule goals. The participants provided that other tools, such as cost and schedule baseline monitoring outside of EVM systems, risk management similar to that highlighted by the Shah (2014) study, issue identification outside of EVM documentation similar to the Moy (2016) study, and other such tools were also helpful in improving cost and schedule outcomes. The leader participants indicated it was important that consideration of more than a single tool provides the best chance of success for meeting cost and schedule outcomes. Participant four stated, "I use EVM in combination with other tools such as risk and scheduling monitoring for the best chance of program success." The documentation for all three companies identified that EVM was only one tool for consideration. In depth details did not exist in the company documentation except that leaders at each respective company needed to find and use whatever tools are available for successful outcomes. The main theme three finding aligned with the review of archival documentation as well including the Lu and Lu (2013) analysis.

Main Theme Four: Leadership Engagement Essential

The fourth and final main theme was that leadership engagement was essential with the EVM data and was most useful for a positive impact on cost and schedule goals. "Whatever I am using EVM or something else, it only works if, as the leader, I stay engaged" (P1). Responses from interview questions two through nine supported this theme with some peripheral support from the response from interview question one that

regarded experience and responsibility. My interviews and document analysis identified leadership engagement as essential 87 times for a 19.55% response rate under main theme four (see Table 6).

Table 6

Frequency of Main Theme Four

Theme	*n*	Rate of Occurrence
Leadership engagement essential	87	19.55%

The participants highlighted the need for leaders to understand the EVM data but then engage the project team for useful application. Participants articulated that data from EVM use could show issues that required additional attention and focus, and that leadership engagement would be necessary for the most likely improved outcomes. "EVM helps me know where problems are, but one of my jobs is to address those problems as the one ultimately responsible for outcomes" (P2). The participants indicated EVM data showed them where they should focus their energy for cost and schedule improvement. They indicated that many times EVM data highlighted issues that other means did not indicate or provide. Participant four stated, "EVM shows me problem areas I would not be aware of, then I work to fix them." Once the participants were aware of an issue, a key for success was engagement.

Company documentation on EVM use and government requirements influencing the respective company's EVM use for all three companies highlighted the need for leadership engagement with EVM use. Similar to the company documentation under

main theme two, there was a noticeable difference between amounts of information provided regarding leadership engagement with EVM use. Company one documentation provided a high-level company goal that leaders should engage with EVM strategy to meet mandatory requirements, while documentation from companies two and three contained more detail on EVM strategy for leaders. Company two documentation had some lower level details on leadership engagement and the author reported that success was dependent on using EVM and understanding outcomes. Company three documentation provided the most detail on EVM strategy and leadership engagement. The author of company three documentation described leadership engagement as the single largest factor in success and further described team interactions with EVM. Descriptions of cross-functional engagement by participants and how each functional team could benefit from the EVM strategy employed by the leader were present. The Besteiro et al. (2015) analysis further supported this theme.

Applications to Professional Practice

The purpose of this qualitative multiple case study was to explore EVM strategies that Washington, D.C. area defense contractor business leaders were using to improve cost and schedule goal accomplishment. The study and analysis associated with the research question, interview responses, company documentation, and archival literature supported identification of the four main themes provided in Section 3. The four main themes identified were: (a) leaders wanted and sought out useful EVM data to improve cost and schedule goals, (b) there were EVM strategies that existed for leaders to use, (c)

EVM use was important it was only one tool of many to use, and (d) leadership engagement was required to gain the most use from EVM data.

This study could be useful to defense business contractor leaders in several ways. As Chen (2014) provided, EVM use supported improved project outcomes and this study aligned with Chen's idea. The findings supported that EVM strategy can improve outcomes with an understanding that organizations need an overarching EVM plan before leaders can identify a specific EVM strategy for their business. A review of the project and existing EVM strategies that might be useful was the next step and aligned with the Hunter et al. (2014) study in that leaders need to understand the scope of a project to best use the tools available. Effective use of EVM strategy induces improved efficiencies and better uses resources, and is similar to the Vanhoucke and Colin (2016) study, the selection of the best strategy improved outcomes more than just using any EVM strategy.

The EVM strategies identified under main theme two included: (a) focused EVM use, (b) comprehension of the data, (c) addressing exposed issues, and (d) continued monitoring of application. Defense business contractor leaders that want improved project cost and schedule outcomes should consider each of these demonstrated strategies. Leaders should also consider their respective business culture impact for EVM strategy use (Anderson, 2016). The third main theme was that EVM use was important but it was only one tool of many to use was key for leaders. Defense business contractors should not rely solely on EVM strategy to change outcomes but rather use it in concert with other project monitoring tools. Other tools exist for leaders for use to improve project outcomes (Acebes et al., 2014). Statements made in the interviews

reflected that defense business leaders that understood EVM and that EVM strategies exist for use and have the opportunity for practical application to professional practice.

Implications for Social Change

The study results contribute to the collection of literature on EVM. EVM strategies gathered in the study could help defense business contractor leaders improve cost and schedule outcomes. The leaders who implement the strategies collected in my research could return resources back to the organization through efficiency. These returned resources, both with time and cost impacts, could support socially responsible and environmental improvement projects that have increase focus across all business sectors (Lubber, 2015).

The use of the EVM strategies collected in my study by defense business contractor leaders can affect positive social change. Defense businesses can have a stigma associated with some projects due to the destructive nature of the systems, but by increased efficiency with EVM strategies, application of resources can go towards social improvement efforts (Ducassy, 2013). A relationship could occur with the defense business contractor leaders and the businesses they work for with the communities these businesses are in. Building a relationship with the local community and focusing on socially important issues from the community can improve community relationships (Ellinger et al., 2013). By choosing environmental improvements and using the resources gained from the EVM strategy use efficiencies, both the company and society could benefit (Ellinger et al., 2013). The community will have more buy-in to what the defense business is doing and employees would likely have additional buy-in to the company

efforts (Ellinger et al., 2013). With a focus on environmental and social improvements, defense business contractor leaders can show they are concerned with what is important to the communities they are in (Ioannou & Serafeim, 2015). Defense businesses could apply the resources gained from EVM efficiency to development less harmful products focused on the community around the business.

Defense businesses located in coastal areas could focus on improving the coastline with pollution initiatives. Leaders could focus on global warming initiatives for reducing fuel use that can have a positive impact on global warming. Defense business leaders could focus on products that use less environmentally toxic materials. Project managers that finish with improved outcomes could allow individuals to volunteer their time in the community. These actions can improve the community and the employees' lives as well. These social or environmental improvements might migrate to other business sectors continuing the social improvement cycle.

Another social change area for consideration of improvement is technological advancement with the resources available from EVM efficiency improvement. Technological advancements could migrate to other business sectors for improvement of people's lives. Lubber (2015) pointed out business changes in improved technology was a catalyst for social improvement. An example is the sidewinder missile, a defense program that focused on the destruction of aircraft in combat, but the missile guidance systems also helped improve safety guidance systems in the commercial industry (Lenfle, 2014). Improvement in EVM strategy use that returns resources for technological advancements can have positive effects on business and social outcomes.

Recommendations for Action

Defense business contractor leaders should review this study with consideration of the strategies for EVM use that could improve project cost and schedule outcomes. Leaders should consider that EVM strategies exist, but EVM is just one tool that can improve cost and schedule outcomes. Government agencies, organizations, individuals in the defense industry, and researchers might find this study useful and should review the results. Leadership engagement is key to project success (Besteiro et al., 2015) and reviewing these study results could be part of that leadership engagement. When leaders review the results, consideration of what their business currently does with EVM versus what the study results show could provide additional EVM strategies for use.

The EVM strategies included focused EVM use, comprehension of the data, addressing exposed issues, and continued monitoring of application. If leaders believe an EVM strategy could be useful, consideration of training and then application of the strategy should take place. These study results along with a culture of learning could improve overall business progress toward goals (Beringer et al., 2013). I plan to disseminate the study results with publication of my doctoral study and provide the results to defense business contractor leaders and organizations with an executive summary of the results. I may also share my results with a presentation at a conference, with an article publication, or with my employer if the circumstances are appropriate.

Recommendations for Further Research

Future researchers should consider conducting additional qualitative research regarding EVM strategy with consideration of the results of this study. Researchers

should consider addressing the identified limitations identified. Limitations were weaknesses in the completed research (Cunha & Miller, 2014). Two limitations were apparent in this study. The first limitation was personal bias that came from my extensive experience with EVM. While my bias was mitigated by using bracketing, which is an acceptable approach in academic research, removing all bias was unlikely (Marshall & Rossman, 2016). Future researchers should consider completing EVM research with having limited EVM experience to mitigate further bias.

The second limitation was the most effective EVM strategy for a specific project was not part of the scope of this study. While demonstrated EVM strategy collection occurred that improved cost and schedule outcomes in defense contractor projects, delineation between those strategies did not happen. Future researchers should consider a deeper analysis between the identified EVM strategies for effectiveness and alignment with specific project types. Defense contractor business leaders will need to determine the EVM strategy most appropriate for their particular project and further research could help. Researcher might also consider other approaches to using EVM that are effective in improving cost and schedule outcomes. Research into other approaches other that EVM may contribute to the overall body of research on improvement of business and project outcomes.

Reflections

While completing my doctoral study, I gathered a much deeper appreciation for doctoral level research. The difference between quantitative and qualitative research became more apparent and a deeper appreciation for the value of semistructured

interviews occurred. I obtained a deeper appreciation for how a doctoral study is completed and the process individuals undergo.

Completing this study showed that EVM can help improve project outcomes but leaders should understand what it can provide, and what it cannot provide. The interviews allowed an insight into the passion defense business contractor leaders have for their respective projects and that they seek improvement of outcomes. I gained a better understanding of the environment the participants operated in, and how they seek to use EVM strategy in their responsibilities. This deeper understanding into EVM strategies and the perspectives of defense business contractor leaders helped me gain a better appreciation for their work in this area.

Conclusion

The goal of this study was to explore EVM strategies defense business contractor leaders used to improve cost and schedule outcomes for projects. I used a qualitative multiple case study for exploration into the phenomenon under review. The findings from the study reflected that defense business contractor leaders could use EVM strategies to improve cost and schedule outcomes for projects. Semistructured interviews along with review of company documentation and other completed EVM research supported the findings.

The participants selected were defense business contractor leaders from the Washington, D.C. area that had demonstrated EVM strategy use. These participants were purposefully selected for insight into the central research question of what EVM strategies do defense contractor business leaders use to improve project cost and schedule

goal accomplishment? Interview questions creation occurred to gather insight into the central research question while allowing participants to leverage their experience in their responses. I used NVivo for organizing, reviewing, and the development of the themes from the interviews. With the study analysis, four main themes emerged. The four main themes derived were: (a) EVM data to improve outcomes, (b) essential strategies exist, (c) EVM is only one tool, and (d) leadership engagement essential with available EVM data was key for the most successful outcomes. The findings from the study provided insight into the business problem that some defense contractor business leaders lacked strategies for EVM use to improve cost and schedule goal accomplishment.

References

Acebes, F., Pajares, J., Galán, J. M., & López-Paredes, A. (2013). Beyond earned value management: A graphical framework for integrated cost, schedule and risk monitoring. *Procedia Social and Behavioral Sciences, 74*, 181-189. doi:10.1016/j.sbsprp.2013.03.027

Acebes, F., Pajares, J., Galán, J. M., & López-Paredes, A. (2014). A new approach for project control under uncertainty. Going back to the basics. *International Journal of Project Management, 32*, 423-434. doi:10.1016/j.ijproman.2013.08.003

Acebes, F., Pereda, M., Poza, D., Pajares, J., & Galán, J. M. (2015). Stochastic earned value analysis using Monte Carlo simulation and statistical learning techniques. *International Journal of Project Management, 33*, 1597-1609. doi:10.1016/j.ijproman.2015.06.012

Aliverdi, R., Naeni, L. M., & Salehipour, A. (2013). Monitoring project duration and cost in a construction project by applying statistical quality control charts. *International Journal of Project Management, 31*, 411-423. doi:10.1016/j.ijproman.2012.08.005

Ancosky, J. (2013). *Defining the role of senior managers: An interpretative phenomenological analysis case study for project management delivery* (Doctoral Dissertation). Retrieved from ProQuest Digital Dissertations and Theses database. (UMI No. 3577480)

Andersen, E. S. (2016). Do project managers have different perspectives on project management? *International Journal of Project Management, 34,* 58-65. doi:10.1016/j.ijproman.2015.09.007

Anyan, F. (2013). The influence of power shifts in data collection and analysis stages: A focus on qualitative research interview. *Qualitative Report, 18*(36), 1-9. Retrieved from http://nsuworks.nova.edu/tqr/

Batselier, J., & Vanhoucke, M. (2015). Evaluation of deterministic state-of-the-art forecasting approaches for project duration based on earned value management. *International Journal of Project Management, 33,* 1588-1596. doi:10.1016/j.ijproman.2015.04.003

Beringer, C., Jonas, D., & Kock, A. (2013). Behavior of internal stakeholders in project portfolio management and its impact on success. *International Journal of Project Management, 31,* 830-846. doi:10.1016/j.ijproman.2012.11.006

Bernard, H. R. (2013). *Social research methods: Qualitative and quantitative approaches* (2nd ed.). Thousand Oaks, CA: Sage.

Besteiro, É. C., de Souza Pinto, J., & Novaski, O. (2015). Success factors in project management. *Business Management Dynamics, 4*(9), 19-34. Retrieved from http://bmdynamics.com

Boonstra, A. (2013). How do top managers support strategic information system projects and why do they sometimes withhold this support? *International Journal of Project Management, 31,* 498-512. doi:10.1016/j.ijproman.2012.09.013

Brakewood, B., & Poldrack, R. A. (2013). The ethics of secondary data analysis: Considering the application of Belmont principles to the sharing of neuroimaging data. *NeuroImage, 82,* 671-676. doi:10.1016/j.neuroimage.2013.02.040

Brigham, M., & Hayes, N. (2013). Hybridity, consulting and e-development in the making: Inscribing new practices of impact assessment and value management. *Information Technology for Development, 19*(2), 112-132. doi:10.1080/02681102.2012.690171

Brinkmann, S., & Kvale, S. (2014). *Interviews: Learning the craft of qualitative research interviewing* (3rd ed.). Thousand Oaks, CA: Sage.

Burau, V., & Andersen, L. B. (2014). Professions and professionals: Capturing the changing role of expertise through theoretical triangulation. *American Journal of Economics & Sociology, 73,* 264-293. doi:10.1111/ajes.12062

Bush, M. (2016). *Strategies affecting the sustainability of small businesses* (Doctoral Dissertation). Retrieved from ProQuest Dissertations and Theses Full Text database. (UMI No. 3746482)

Byung-Cheol, K., & Seong-Jin, K. (2015). Credibility evaluation of project duration forecast using forecast sensitivity and forecast-risk compatibility. *Journal of Construction Engineering & Management, 141*(8), 1-13. doi:10.1061/(ASCE)CO.1943-7862.0001000

Cantwell, P. R., Mazzuchi, T. A., & Sarkani, S. (2013). Dynamic consequences of cost, schedule, and performance within DoD project management. *Defense Acquisition Research Journal*, *20*, 89-116. Retrieved from http://www.dau.mil/publications /DefenseARJ/default.aspx

Caron, F., Ruggeri, F., & Merli, A. (2012). A Bayesian approach to improve estimate at completion in earned value management. *Project Management Journal*, *44*, 3-16. doi:10.1002/pmj

Chaplain, C. (2015). Management tools should better track to cost and schedule commitments to adequately monitor increasing risk. *GAO Reports 15-596*, 1-32. Retrieved from http://www.gao.gov/

Chen, H. L. (2014). Improving forecasting accuracy of project earned value metrics: Linear modeling approach. *Journal of Management in Engineering*, *30*, 135-145. doi:10.1061/(ASCE)ME.1943-5479.0000187

Christ, T. W. (2013). The worldview matrix as a strategy when designing mixed methods research. *International Journal of Multiple Research Approaches, 7*(1), 110-118. doi:10.5172/mra.2013.7.1.110

Colin, J., Martens, A., Vanhoucke, M., & Wauters, M. (2015). A multivariate approach for top-down project control using earned value management. *Decision Support Systems, 79*, 65-76. doi:10.1016/j.dss.2015.08.002

Colin, J., & Vanhoucke, M. (2015). Developing a framework for statistical process control approaches in project management. *International Journal of Project Management, 33*, 1289-1300. doi:10.1016/j.ijproman.2015.03.014

Cope, D.G. (2014). Methods and meanings: Credibility and trustworthiness of qualitative research. *Oncology Nursing Forum*, *41*(1), 89-91. doi:10.1188/14.ONF.89-91

Corbin, J., & Strauss, A. (2014). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (3rd ed.). Los Angeles, CA: Sage.

Cunha, J. M., & Miller, T. (2014). Measuring value-added in higher education: Possibilities and limitations in the use of administrative data. *Economics of Education Review*, *42*, 64-77. doi:10.1016/j.econedurev.2014.06.001

Czemplik, A. (2014). Application of earned value method to progress control of construction projects. *Procedia Engineering*, *91*, 424-428. doi:10.1016/j.proeng.2014.12.087

Dasgupta, M. (2015). Exploring the relevance of case study research. *Vision*, *19*(2), 147-160. doi:10.1177/0972262915575661

De Marco, A., & Narbeav, T. (2013). Earned value-based performance monitoring of facility construction projects. *Journal of Facilities Management*, *11*, 69-80. doi:10.1108/14725961311301475

Domingos, C. B., Bosque, R., Cassimiro, J., Colli, G. R., Rodrigues, M. T., Marcella G., Beheregaray, L. B. (2014). Out of the deep: Cryptic speciation in a neo-tropical gecko (Squamata, Phyllodactylidae) revealed by species delimitation methods. *Molecular Phylogenetics and Evolution*, *80*, 113-124. doi:10.1016/j.ympev.2014.07.022

Donovan, B. (2015). Still proving its value. *PM Network, 29*(2), 52-61. Retrieved from http://www.pmi.org/learning/publications/pm-network

Drury-Grogan, M. L. (2014). Performance on agile teams: Relating iteration objectives and critical decisions to project management success factors. *Information and Software Technology, 56,* 506-515. doi:10.1016/j.infsof.2013.11.003

Ducassy, I. (2013). Does corporate social responsibility pay off in times of crisis? An alternate perspective on the relationship between financial and corporate social performance. *Corporate Social Responsibility and Environmental Management, 20*(3), 157-167. doi:10.1002/csr.1282

Ellinger, A.E., Findley Musgrove, C. (C.), Ellinger, A.D., Bachrach, D.G., Elmadağ Baş, A.B., & Wang, Y-L. (2013). Influences of organizational commitment in social capital on service employee commitment and performance. *Journal of Business Research, 66,* 1124-1133. doi:10.1016/j.jbusres.2012.03.008

Elshaer, R. (2013). Impact of sensitivity information on the prediction of project's duration using earned schedule method. *International Journal of Project Management, 31,* 579-588. doi:10.1016/j.ijproman.2012.10.006

Emerson, R. W. (2015). Convenience sampling, random sampling, and snowball sampling: How does sampling affect the validity of research? *Journal of Visual Impairment & Blindness, 109*(2), 164-168. Retrieved from http://www.afb.org/jvib/jvib_main.asp

Farok, G. M. G., & Garcia, J. A. (2015). Developing group leadership and communication skills for monitoring EVM in project management. *Journal of Mechanical Engineering, 45,* 53-60. Retrieved from http://www.sv-jme.eu/home/

Finardi, U. (2013). Correlation between journal impact factor and citation performance: An experimental study. *Journal of Informetrics, 7*, 357-370. doi:10.1016/j.joi.2012.12.004

Finlay, L. (2014). Embodying research. *Person-Centered & Experiential Psychotherapies*, *13*, 4-18. doi:10.1080/14779757.2013.855133

Fusch, P., & Ness, L. (2015). Are we there yet? Data saturation in qualitative research. *The Qualitative Report*, *20*, 1408-1416. Retrieved from http://nsuworks.nova.edu/tqr/

Gershon, M. (2013). Using earned value analysis to manage project. *Journal of Applied Business and Economics*, *15*, 11-14. Retrieved from http://www.aebrjournel.org

Gilbreth, F. B., & Carey, E. G. (1948). *Cheaper by the dozen*. Springfield, OH: Crowell.

Groeneveld, S., Tummers, L., Bronkhorst, B., Ashikali, T., & van Thiel, S. (2015). Quantitative methods in public administration: Their use and development through time. *International Public Management Journal*, *18*, 61-86. doi:10.1080/10967494.2014.972484

Haji-Kazemi, S., Andersen, B., & Krane, H. P. (2013). A review on possible approaches for detecting early warning signs in projects. *Project Management Journal*, *44*, 55-69. doi:10.1002/pmj.21360

Hazır, Ö. (2015). A review of analytical models, approaches and decision support tools in project monitoring and control. *International Journal of Project Management*, *33*, 808-815. doi:10.1016/j.ijproman.2014.09.005

Houghton, C., Casey, D., Shaw, D., & Murphy, K. (2013). Rigour in qualitative case-study research. *Nurse Researcher, 20*(4), 12-17. doi:10.7748/nr.2013.03.20.4.12.e326

Hunter, H., Fitzgerald, R., & Barlow, D. (2014). Improved cost monitoring and control through the earned value management system. *Acta Astronautica, 93,* 497-500. doi:10.1016/j.actaastro.2012.09.010

Hussein, A. (2015). The use of triangulation in social sciences research: Can qualitative and quantitative methods be combined? *Journal of Comparative Social Work, 4,* 1-12. Retrieved from http://journal.uia.no/index.php/JCSW

Ioannou, I., & Serafeim, G. (2015). The impact of corporate social responsibility on investment recommendations: Analysts' perceptions and shifting institutional logics. *Strategic Management Journal, 36,* 1053-1081. doi:10.1002/smj.2268

Izard-Carroll, M. (2016). *Public sector leaders' strategies to improve employee retention*. (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses Full Text database. (UMI No. 10055818)

Joslin, R., & Müller, R. (2015). Relationships between a project management methodology and project success in different project governance contexts. *International Journal of Project Management, 33,* 1377-1392. doi:10.1016/j.ijproman.2015.03.005

Kaiser, M. G., El Arbi, F., & Ahlemann, F. (2015). Successful project portfolio management beyond project selection techniques: Understanding the role of structural alignment. *International Journal of Project Management*, *33*, 126-139. doi:10.1016/j.ijproman.2014.03.002

Kemparaj, U., & Chavan, S. (2013). Qualitative research: A brief description. *Indian Journal of Medical Sciences*, *67*, 89-98. doi:10.4101/0019-5359.121127

Kerzner, H. R. (2013). *Project management: A systems approach to planning, scheduling, and controlling* (11th ed.). Hoboken, NJ: John Wiley & Sons.

Khamooshi, H., & Golafshani, H. (2014). EDM: Earned duration management, a new approach to schedule performance management and measurement. *International Journal of Project Management*, *32*, 1019-1041. doi:10.1016/j.ijproman.2013.11.002

Khan, S. N. (2014). Qualitative research method - phenomenology. *Asian Social Science*, *10*, 298-310. doi:10.5539/ass.v10n21p298

Kim, B. C., & Reinschmidt, K. F. (2011). Combination of project cost forecasts in earned value management. *Journal of Construction Engineering and Management*, *137*, 958-966. doi:10.1061/(ASCE)CO.1943-7862.0000352

Klabunde, C. N., Willis, G. B., & Casalino, L. P. (2013). Facilitators and barriers to survey participation by physicians: A call to action for researchers. *Evaluation & the Health Professions*, *36*, 279-295. doi:10.1177/0163278713496426

Klitzman, R. (2013). How good does the science have to be in proposals submitted to institutional review boards? An interview study of institutional review board personnel. *Clinical Trials, 10,* 761-766. doi:10.1177/1740774513500080

Kwak, Y. H., & Anbari, F. T. (2012). History, practices, and future of earned value management in government: Perspectives from NASA. *Project Management Journal, 43,* 77-90. doi:10.1002/pmj.20272

Lech, P. (2013). Time, budget and functionality? IT project success criteria revised. *Information Systems Management, 30,* 263-275. doi:10.1080/10580530.2013.794658

Lenfle, S. (2014). Toward a genealogy of project management: Sidewinder and the management of exploratory projects. *International Journal of Project Management, 32,* 921-931. doi:10.1016/j.ijproman.2013.10.017

Lu, W., & Lu, L. (2013). Extreme programming project performance management by statistical earned value analysis. *Global Journal of Business Research, 7,* 115-120. Retrieved from http://www.journals.elsevier.com/journal-of-business-research/

Lubber, M. S. (2015). Business as the engine for social change. McKinsey & Company. Retrieved from http://voices.mckinseyonsociety.com/business-as-the-engine-for-social-change/

Maheshwari, S., & Credle, S. H. (2010). Project management: using Earned Value Analysis (EVA) to monitor a project's progress. *Journal of the International Academy for Case Studies, 1*, 13-22. Retrieved from http://www.alliedacademies.org/the-international-academy-for-case-studies/

Marshall, B., Cardon, P., Poddar, A., & Fontenot, R. (2013). Does sample size matter in qualitative research?: A review of qualitative interviews in IS research. *Journal of Computer Information Systems*, *54*(1), 11-22. Retrieved from http://iacis.org/jcis/jcis.php

Marshall, C., & Rossman, G. (2016). *Designing qualitative research* (6th ed.). Thousand Oaks, CA: Sage.

Martinez-del-Rio, J. & Céspedes-Lorente, J. (2014). Competitiveness and legitimation: The logic of companies going green in geographical clusters. *Journal of Business Ethics, 120,* 131-146. doi:10.1007/s10551-013-1636-z

Mir, F. A., & Pinnington, A. H. (2014). Exploring the value of project management: Linking project management performance and project success. *International Journal of Project Management, 32*, 202-217. doi:10.1016/j.ijproman.2013.05.012

Morin, K. H. (2013). Value of a pilot study. *Journal of Nursing Education, 52*, 547-548. doi:10.3928/01484834-20130920-10

Mortaji, S. T. H., Bagherpour, M., & Noori, S. (2013). Fuzzy earned value management using L-R fuzzy numbers. *Journal of Intelligent & Fuzzy Systems, 24*, 323-332. doi:10.3233/IFS-2012-0556

Mostafa, S., Bagherpour, M., & Kamyabniya, A. (2014). Fuzzy extended earned value management: A novel perspective. *Journal of Intelligent & Fuzzy Systems, 27,* 1393-1406. doi:10.3233/IFS-131106

Moy, M. (2016). *Evaluating federal information technology program success based on earned value management*. (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses Full Text database. (UMI No. 10013915)

Naeni, L. M., Shadrokh, S., & Salehipour, A. (2014). A fuzzy approach for the earned value management. *International Journal of Project Management, 32*, 709-716. doi:10.1016/j.ijproman.2013.02.002

Narbaev, T., & De Marco, A. (2013). Combination of growth model and earned schedule to forecast project cost at completion. *Journal of Construction Engineering and Management, 140*, 04013038. doi:10.1061/(ASCE)CO.1943-7862.0000783

National Commission for the Protection of Human Subjects in Biomedical and Behavioral Research. (1979). *The Belmont report: Ethical principles and guidelines for the protection of human subject's research*. Washington, D.C.: National Institutes of Health. Retrieved from http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html

Nazilli, H., & Postavaru, N. (2012). Review of variance analysis in unit price or lump-sum basis contracts for a construction project. *Internal Auditing and Risk Management, 7*(2), 103-115. Retrieved from http://univath.ro/aimr/en/content/home

Olson, B. A., Mazzuchi, T. A., Sarkani, S., & Forsberg, K. (2012). Problem management process, filling the gap in the systems engineering processes between the risk and opportunity processes. *Systems Engineering, 15*, 275-286. doi:10.1002/sys.20209

Palinkas, L. A., Horwitz, S. M., Green, C.A., Wisdom, J. P., Duan, N., & Hoagwood, K. (2013). Purposive sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*. Advance online publication. doi:10.1007/s10488-013-0528-y

Patton, M. Q. (2015). *Qualitative research and evaluation methods* (5th ed.). Thousand Oaks, CA: Sage.

Pearce, G., Thøgersen-Ntoumani, C., & Duda, J. L. (2014). The development of synchronous text-based instant messaging as an online interviewing tool. *International Journal of Social Research Methodology, 17*, 677-692. doi:10.1080/13645579.2013.827819

Perez, D. F., Nie, J. X., Arden, C. I., Radhu, N., & Ritvo, P. (2013). Impact if participant incentives and direct and snowball sampling on survey response rate in an ethnically diverse community: Results from a pilot study of physical activity and the built environment. *Journal of Immigrant Minority Health, 15*, 2017-214. doi:10.1007/s10903-011-9525-y

Plumer, D. R. (2010). *The relationship between earned value management metrics and customer satisfaction* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses Full Text database. (UMI No. 744105110)

Ramos, P., & Mota, C. (2014). Perceptions of success and failure factors in information technology projects: A study from Brazilian companies. *Procedia - Social and Behavioral Sciences, 119,* 349-357. doi:10.1016/j.sbspro.2014.03.040

Reich, B. H., Gemino, A., & Sauer, C. (2014). How knowledge management impacts performance in projects: An empirical study. *International Journal of Project Management, 32,* 590-602. doi:10.1016/j.ijproman.2013.09.004

Salari, M., Bagherpour, M., & Reihani, M. H. (2015). A time-cost trade-off model by incorporating fuzzy earned value management: A statistical based approach. *Journal of Intelligent & Fuzzy Systems, 28,* 1909-1919. doi:10.3233/IFS-141478

Sasirekha, V., & Tripathi, G. K. (2013). Productivity Improvement: A work study analysis at the audio division of Hyundai Mobis India Ltd. *IUP Journal of Operations Management, 12,* 16-26. Retrieved from http://www.iupindia.in/Operations_Management.asp

Shah, A. H. (2014). *Examining the perceived value of integration of earned value management with risk management-based performance measurement baseline* (Doctoral dissertation). Retrieved from ProQuest Dissertations and Theses database. (UMI No. 3612243)

Sheffield, J., & Lemétayer, J. (2013). Factors associated with the software development agility of successful projects. *International Journal of Project Management, 31,* 459-472. doi:10.1016/j.ijproman.2012.09.011

Smartt, C., & Ferreira, S. (2014). Exploring beliefs about using systems engineering to capture contracts. *Procedia Computer Science, 28,* 111-119. doi:10.1016/j.procs.2014.03.015

Thamhain, H. (2013). Managing risks in complex projects. *Project Management Journal, 44*, 20-35. doi:10.1002/pmj.21325

Townsend, L., Mazzuchi, T., & Sarkani, S. (2014). A schedule-performance approach for level-of-effort tasks. *Engineering Management Journal, 26*(1), 21-30. doi:10.1080/10429247.2014.11432001

Trietsch, D., & Baker, K. R. (2012). Pert 21: Fitting PERT/CPM for use in the 21st century. *International Journal of Project Management, 30*, 490-502. doi:10.1016/j.ijproman.2011.09.004

Tuohy, D., Cooney, A., Dowling, M., Murphy, K., & Sixmith, J. (2013). An overview of interpretive phenomenology as a research methodology. *Nurse Researcher, 20*(6), 17-20. doi:10.7748/nr2013.07.20.6.17.e315

Turskis, Z., Gajzler, M., & Dziadosz, A. (2012). Reliability, risk management, and contingency of construction processes and projects. *Journal of Civil Engineering and Management, 18,* 290-298. doi:10.3846/13923730.2012.672931

Unger, B. N., Kock, A., Gemünden, H. G., & Jonas, D. (2012). Enforcing strategic fit of 104 project portfolios by project termination: An empirical study on senior management involvement. *International Journal of Project Management, 30,* 675-685. doi:10.1016/j.ijproman.2011.12.002

U.S. General Accounting Office. (2012). NASA: *Earned value management implementation across major spaceflight projects is uneven*. Retrieved from http://www.gao.gov/products/GAO-13-22

Uzzafer, M. (2013). A simulation model for strategic management process of software projects. *Journal of Systems and Software*, *86*, 21-37. doi:10.1016/j.jss.2012.06.042

Vanhoucke, M., & Colin, J. (2016). On the use of multivariate regression methods for longest path calculations from earned value management observations. *Omega, 61*, 127-140. doi:10.1016/j.omega.2015.07.013

Wauters, M., & Vanhoucke, M. (2014). Support vector machine regression for project control forecasting. *Automation in Construction*, *47*, 92-106. doi:10.1016/j.autcon.2014.07.014

Weerawardena, J., Mort, G. S., Salunke, S., Knight, G., & Liesch, P. W. (2014). The role of the market sub-system and the socio-technical sub-system in innovation and firm performance: a dynamic capabilities approach. *Journal of the Academy of Marketing Science*, *43*(2), 1–19. doi:10.1007/s11747-014-0382-9

Whiffin, C. J., Bailey, C., Ellis-Hill, C., & Jarrett, N. (2014). Challenges and solutions during analysis in a longitudinal narrative case study. *Nurse Researcher*, *21*(4), 20-26. Retrieved from http://rcnpublishing.com/journal/nr

Wiesenfeld, B. M., & Brockner, J. (2012). On the reciprocal relationship between basic and applied psychological theory. *Organizational Psychology Review*, *2*, 172-182. doi:10.1177/2041386611428501

William, T., Klakegg, O. J., Walker, D. H. T., Andersen, B., & Magnussen, M. (2012). Identifying and acting on early warning signs in complex projects. *Project Management Journal*, *43*, 37-53. doi:10.1002/pmj.21259

Willems, L. L., & Vanhoucke, M. (2015). Classification of articles and journals on project control and earned value management. *International Journal of Project Management*, *33*, 1610-1634. doi:10.1016/j.ijproman.2015.06.003

Wnuk, K., Gorschek, T., & Zahda, S. (2013). Obsolete software requirements. *Information and Software Technology*, *55*, 921-940. doi:10.1016/j.infsof.2012.12.001

Wysocki, R. K. (2014). *Effective project management: Traditional, agile, extreme* (7th ed). Indianapolis, IN: John Wiley & Sons.

Yang, L., Huang, C., & Hsu, T. (2014). Knowledge leadership to improve project and 108 organizational performance. *International Journal of Project Management*, *32*, 40-53. doi:10.1016/j.ijproman.2013.01.011

Yilmaz, K. (2013). Comparisons of quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences. *European Journal of Education*, *48*, 311-325. doi:10.1111/ejed.12014

Yin, R. K. (2014). *Case study research: Design and methods* (4th ed.). Thousand Oaks, CA: Sage.

Young, R., & Poon, S. (2013). Top management support—almost always necessary and sometimes sufficient for success: Findings from a fuzzy set analysis. *International Journal of Project Management*, *31*, 943-957. doi:10.1016/j.ijproman.2012.11.013

Appendix A: Interview Protocol and Consent Form

The purpose of this study is exploration into EVM strategy used by defense business contractor leaders for improvement of cost and schedule outcomes. Eligibility criteria for participation are defense business contractor leaders in the Washington, D.C. area that have demonstrated use of EVM strategy for improvement of cost and schedule outcomes. The study is being conducted to capture EVM strategy that defense business contractor leaders could use in the future. Your participation will help gather these strategies. At no time, should there be the risk of harm to the participant or researcher from taking part in this study. Defense business contractor leaders' interviews will occur under the following interview protocol.

Study Benefits:

Potential benefits from this study include identifying EVM strategy used by defense business contractor leaders that other leaders in the defense business sector might use. EVM strategy identified could have social benefits by improving defense program efficiency relative to cost and schedule so project funds use for areas such as environmental improvements could happen. An executive summary of the study and results will be provided to participants upon study completion.

Voluntary Nature of the Study:

All efforts to follow the interview protocol will occur but at any time, the participant has the ability to question the protocol for clarity or stop participation. There will be no negative outcomes from withdrawing from the study at any time. Furthermore, while an explanation of withdrawal would be helpful, there is no requirement for a participant to explain the reasoning for withdrawal. There is minimal risk or personal discomfort associated with participation in this study.

There will be no compensation, gifts, or reimbursement for participating in the study.

Time Commitment:

The participant should plan for two 60 minutes blocks of time for study participation with the potential for a limited amount of time above those requirements only as necessary. The interview should take approximately 60 minutes. The interviews will be audio recorded. The member checking activity after the interview is complete should take approximately 60 minutes. Member checking will occur after the initial interview and will be a follow-up discussion to ensure themes and input the participant was trying to portray was captured accurately. Member checking is basically a follow-up discussion to ensure the participant is satisfied with what the researcher captured. All efforts to stay within these time parameters will occur.

Privacy:

All personally identifiable information will remain confidential. Any responses provided will remain confidential. All data will be stored securely for the next five years and then destroyed. Coding of information will occur instead of personal identifiable information in which the researcher is the only individual with access.

The following are the proposed interview questions:

1. What is your experience and background using EVM as a defense contractor business leader in your industry organization?
2. What EVM strategies have you used that improve a PM's ability to meet cost and schedule goals?
3. Why did you implement EVM strategy for the projects at all?
4. How has using EVM improved project management in your organization?
5. What does EVM bring to a Project Manager's (PM) tool set to meet cost and schedule goals that other mechanisms do not?
6. What challenges have you encountered measuring the value of an EVM strategy on a project in the sense of positive or negative impact on cost and schedule goal accomplishment?
7. How were these challenges measuring the value of EVM addressed?
8. What implementation processes did you use to gain the most value from EVM use?
9. What additional considerations would you like to add regarding the use of EVM and EVM's value as a process in project management?

Statement of Consent:
Statement of consent was received via email with the words "I consent" in the response to the participation email request. It is important to note that participation is voluntary and you may withdraw from the study at any time.

Researcher Contact Information:
Email: redacted; Phone: redacted
Please contact me via these means with any questions or concerns.
You may also contact the Walden Institutional Review Board (IRB) with questions about your rights as a participant at irb@mail.waldenu.edu