

FACTORS OF SUCCESS IN PERFORMANCE INFORMATION PROCUREMENT SYSTEM / PERFORMANCE INFORMATION RISK MANAGEMENT SYSTEM

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Factors of success in Performance Information Procurement System / Performance Information Risk Management System

Jacob Shizuo Kashiwagi

Proefschrift Technische Universiteit Delft

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Preface

Leonardo Da Vinci once stated, "Simplicity is the ultimate sophistication." It was my desire to express the development, refinement, and wisdom the academic system and community has given to me in a body of work that would take a portion of the confusion and complexity in the world and reveal a simple solution.

Through using a deductive research philosophy, factors improving the performance and efficiency of service delivery were discovered. Bringing to light simple and inexpensive business practices that in many cases minimized common problems and inefficiencies, improved performance, increased customer satisfaction, and decreased cost. Identifying a new methodology that could potentially improve service delivery in all areas of the industry. Revealing that the current problems with service delivery is not a technical issue, but one of resource alignment.

This research has taken me on an amazing journey and has taught me many lessons. One of the most important being, research cannot be performed alone. There are many individuals and organizations that have played a critical role in the research performed. Providing me with the opportunities, guidance, and support, such an effort requires. I would like to thank my promotion committee members for taking the time to review my work. The Dutch professional community for being open and supportive of a new way of business.

I would like to express my gratitude and appreciation to the following individuals and organizations:

- Academic Partners: Morgan Fitkin, Neha Joshi, Kayla Krassa, Alice Stevens, Eric Ferrin, Tyson Thurman, and Danielle Ford.
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I would like to offer special thanks to the following individuals that have impacted my life and work in ways words cannot express:

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- Professor Dean and Judy Kashiwagi
- Professor William and Janie Badger
- Jeroen Van de Rijt

Last, but not least, I would like acknowledge my beautiful wife and family for their understanding, patience, and support they have provided me throughout my academic career.

Abstract

The current economy has placed pressure on private and public organizations to become more efficient. Increasing requirements and expectations and decreasing resources are making it difficult for organizations to deliver their services on-time, on-budget, with high customer satisfaction. This has caused both professionals and academics to search for ways to minimize waste throughout the entire supply chain.

Buyer/Supplier interaction has been one of the major areas of focus to improve the performance and efficiency of service delivery. Buyer/Supplier interaction includes such activities as: selection of suppliers, development of a contracts, and management of services. In 2008, the International Council for Building (CIB), a professional construction industry group performed (Egbu et al. 2008) a worldwide study identifying innovative construction methods that utilized performance metrics to increase project performance and efficiency. The study filtered through more than 15 million articles and reviewed more than 4,500 articles. In the end, the study identified only one system that had documentation showing it could consistently improve project performance. The system was a buyer/supplier interaction model called: Performance Information Procurement System / Performance Information Risk Management System (PIPS/PIRMS).

Since 2008, the PIPS/PIRMS system has gained worldwide attention, due to its ability improve construction performance. The purpose of this research was to take an in-depth look into the PIPS/PIRMS system and identify factors that allow this model to improve performance of construction services that traditional methods do not use. Research was also performed to identify if the factors could be implemented into any Buyer/Supplier interaction model to improve service efficiency and performance.

Through an in-depth literature research on buyer/supplier interaction models a comparison was made and eight factors were discovered that made the PIPS/PIRMS model unique from other buyer/supplier interaction models. Practitioners were surveyed to validate the uniqueness of the eight factors and predict the potential impact the factors could have on the performance and efficiency of delivered services. The final stage of the research involved conducting case study research with five clients implementing the eight factors on thirty-one different services, ranging from dining services to mental health services.

The research results discovered the factors were able to decrease cost, increase value, and improve customer satisfaction of the services. The research indicated that improving performance and efficiency was a resource alignment issue rather than a technical issue.

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1 Introduction

1.1 General Introduction

The construction industry has had a problem with delivering projects efficiently and with customer satisfaction. Both professionals and academics have been unable to identify a sustainable solution to the problem. Many solutions have been proposed, few have been able to produce successful results.

In 1994, a landmark study was published by Sir Michael Latham (1994) identifying the continued failings of the construction industry in the UK. Latham's report brought to the fore front many industry problems that had been identified for the last 30 years. Latham identified business practices as the reason for the adversarial environment, inefficiency, and low performance in construction projects. The report caught the attention of many buyers and suppliers in the construction industry and was the motivating factor in many industry initiatives in the late 1990's.

Although the industry performed many reform efforts, buyers in the construction industry were still not satisfied with the performance of construction projects. In 1997, the UK commissioned a task force headed by John Egan (1998) to perform another study to identify solutions to the industry's problems, this time approaching the situation from the buyer's perspective. The study identified a need for more leadership and integrated processes and teams. The Egan report, like the Latham report, initiated many efforts to improve the performance of the industry. Despite the efforts initiated by the Latham and Egan reports, the performance of construction did not improve in the early 2000's and the industry has only recently seen slight improvement in certain areas. In fact, in many the performance of the industry has decreased. Overall efficiency and productive construction projects have struggled (Chikuni & Hendrik 2012; Oyedele et al. Georgy et al. 2005; Bernstein 2003).

The 2011 United Kingdom Performance Report, based on the Key Performance Indicators (KPI) of the UK construction industry, showed slight improvements from 2000 to 2011 (UK Report 2011):

- Overall Customer Satisfaction increased from 63% to 80%, however satisfaction for projects over 5M Euros was slightly lower at 73%.
- Projects completing on time or better rose from 28% to 45%.
- Projects completing on budget rose from 50% to 63%.

Despite the increases in performance from 2000, the construction industry still has room to improve, with only 45% of projects completing on time and 63% completing on budget. The UK industry report also showed that other indicators are showing that the performance of construction projects is still struggling (UK Report 2011):

- Contractor satisfaction with client provision of information remained at 69% from 2010. This KPI increased only 5% from the initial measurement in 2003.

- Contractor profitability declined to 5% from 7.7% in 2010.
- The clients rating of the amount of defects on projects declined to 68% from 75% in 2010. The client rating on defects on a project is only 3% higher than the initial client rating in 2000 (65%).

The declining profitability of construction companies and the amount of defects on projects show that the industry has not yet stabilized its performance.

Multiple studies have been performed in the United States showing similar results of construction non-performance (Meyer et al. 2010; Davis et al. 2009; Lapatner 2007; Construction Financial Management Association 2006; Simonson 2006). The following are additional findings showing a struggling construction industry:

- The construction industry has experienced a decrease in productivity at the rate of .8% per year (Adrian 2001).
- Construction companies have the second highest failure and bankruptcy rate (95%) (Simonson 2006).
- During 2005-2006, only 60% of the contractors were profitable, 20% broke even, and 20% had negative net income (Associated General Contractors 2006).
- 49.6% of the time in construction is devoted to wasteful activities (Lapatner 2007)
- Over 90% of transportation construction jobs are over-budget. (Lapatner 2007)
- Construction companies are estimated to waste at least \$15.8B per year on inefficient communication. (Lapatner 2007)

The low performance has not only been identified on the actual construction, but also in the design and engineering professions. The Construction Management Association of America (CFMA 2006) found that over 50% of design efforts finish behind or significantly behind schedule. Furthermore, it found that 70% of clients have seen the quality of design documents decrease over the past ten years with 97% of clients agreeing that designers should be held more accountable for the quality of the designs that are delivered.

With the decrease in the performance, the construction industry has seen an increase in disputes, claims, and litigation, which has been another cause for the decrease in efficiency and increase in wasted resources (Moyo & Maritz 2012). One industry expert expressed their view on the U.S. construction process, "The sad and hard truth is that the bidding-and-building process in the U.S. has been corrupted by the manipulative practices of all the participants. Unfortunately, the last phase of most major or otherwise complex construction projects has not been completion, but litigation" (Shearer 2000).

Forecasts of future performance of the industry does not look promising, as it has been identified that there is a lack of skilled labor, including, craftsmen, engineers, and managers (Missa & Vian 2012; Dlamini & Hendrik 2012; National Defense University 2005). It is important to note that the shortage of labour supply is not in finding people to perform the work. The shortage is in labour that is skilled and trained at doing the work. The danger that has been identified is that the industry has decreased the training it is providing to the current work force. The UK Industry Report identified that the average

training day per full time employee is less than 1 day a year (.6 days). This is the lowest it has ever been.

The documented poor performance of the construction industry and the decreasing supply of skilled labour have challenged many experts and researchers in the construction industry to finding a solution to increase the efficiency and performance of construction services. Although, the industry in some cases have seen improvements in performance and customer satisfaction over the last decade, the industry has yet to develop a process that consistently delivers construction services efficiently (Sullivan et al. 2012; Olatunji et al. 2012; Gajjar et al. 2012; Lapatner 2007; Kenny 2009; Sambasivan & Soon 2006; Chen et al. 2010; Munting & Cruywagen 2008; Kazaz & Birgonul 2005; Binici et al. 2010; Palliyaguru et al. 2008; Ekolua & Ballima 2006). For more information on the non-performance and inefficiency of the construction industry, please see Appendix A in the Appendices document located at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

If the construction industry keeps moving in the direction that the performance data is showing it will cause increasing problems in society (De Ridder 2011). The problems the construction industry is facing and the difficulties it is going through, can be seen in many other industries, such as the Information Communication Technology industry (Kerzner 2011; Vital Smarts et al. 2006). Peter Krumm and Hans de Jonge (1998) identified the same problems in corporate real estate management. Finding a solution to reverse this trend in the construction industry will enable society not only to free up resources that can be used for development and advancements in construction and other industries, but it will also enable other industries to reverse their own problems and inefficiencies.

1.2 Buyer/Supplier Systems

One of the main areas that the industry has focused on to improve performance of construction services has been with construction buyer/supplier systems.

A buyer/supplier system is defined as:

A structure/process/system that governs the interactions between a buyer and a supplier(s) in the exchange of goods or services. The buyer being identified as an entity that is acquiring a good or service and a supplier as someone that is offering a good or service to be acquired.

In a construction project, the buyer/supplier system will affect (Xianhai 2010; Hu 2008; Guikema et al. 2009; Cheng et al. 2008; Kashiwagi 2012):

- How the buyer will manage and inspect the supplier. In construction many resources are spent to ensure that the buyer is able to control the supplier and complete the project in a manner that they approve of.

- What performance information the buyer expects from the supplier, including, the format of the information, the documentation of the information, and the frequency that the information is submitted.
- What type of communication is expected between the buyer and the supplier. This includes what type of information the supplier expects from the buyer.
- How decisions will be made on a project. Identifying who has what authority and the role the buyer and supplier will take.
- How the supplier will manage themselves. What role the buyer will take in directing and inspecting the supplier.
- The type of contractual agreement that will be developed and adhered to.

Below are some of the major initiatives that have occurred in the construction industry dealing with buyer/supplier systems (Bemelmans et al. 2012; Strang 2002; Jin & Doloi 2008; Shaoyan 2009; Xu & Yu 2008):

- Partnering
- Construction Management at Risk
- Project Management Handbook
- Public Private Partnerships (PPP)
- Technology Developments (BIM and Last Planner)

1.2.1 Performing Buyer/Supplier Systems

Although, lots of resources have gone into developing buyer/supplier systems, there has not been many buyer/supplier systems developed in the last decade that have performance documentation that shows the system actually increase customer satisfaction and value (in terms of cost, time, and quality) on construction projects.

In 2006, the International Council for Building (CIB) sanctioned a Task Group (TG61), which is now CIB Working Commission W117, with the purpose of investigating construction performance information and how it can be leveraged to improve the construction industry on a global scale. In 2008, TG61 (Egbu et al. 2008) performed a worldwide study identifying innovative construction methods that utilized performance metrics to increase project performance. The study filtered through more than 15 million articles and reviewed more than 4,500 articles. In the end, the study identified 16 articles that had documented measurements showing an increase in construction performance due to the construction method utilized. The study found only three construction methods that proved it could improve customer satisfaction and value on projects and that had been run on multiple tests.

One of the three construction methods found was a buyer/supplier system called Performance Information Procurement System / Performance Information Risk Management System (PIPS/PIRMS). The study found that out of the 16 articles with documented performance measurements, 75% (12) of the articles were projects performed on PIPS/PIRMS.

The other two methods were the Performance Assessment Scoring System (PASS) (Tam et al. 2000) and the City of Fort Worth Equipment Services Department (ESD - FT) (Stewart 2005). After further investigation, it was found that although the PASS had measured performance information, the system could not show any improvement in performance of their projects. The ESD -FT had measurements to show improvement in their projects, however, this system did not have documented information for how the process worked. It also was a process that was internal to the organization and did not involve projects with suppliers or other organizations.

PIPS/PIRMS was the only process that had sufficient documentation showing that it could improve customer satisfaction and value on projects in the construction industry that involved suppliers.

1.3 Performance Information Procurement System / Performance Information Risk Management Process (PIPS/PIRMS)

1.3.1 Introduction

The Performance Information Procurement System / Performance Information Risk Management Process (PIPS/PIRMS), was developed by Dr. Dean Takeo Kashiwagi, from Arizona State University. The system was first conceived in 1991 as part of Kashiwagi's dissertation (1991). PIPS/PIRMS was originally, strictly a selection process. The first test of the process was performed in 1994 (Kashiwagi & Savicky 2002), used to select roofing systems and contractors for private organizations (including: Intel, IBM, and McDonald Douglas) The system was documented and performed so well, for the roofing industry, the system spread to other construction areas. It has been transformed into a selection, measurement, risk, and management model (Kashiwagi 2012).

1.3.2 PIPS and PIRMS Model

Since 1992, the PIPS/PIRMS process has been through many changes. Even though the technical steps and processes have changed, the focus and concepts that create the foundation of the system have remained the same. It was not until late 2009 that a clear separation between PIPS and PIRMS was established (Kashiwagi 2009). PIPS identified as the selection process and PIRMS was the project and risk management model. The separation allowed buyers to run PIRMS without running PIPS (the selection process) on projects. Both systems are built on the same ideas and principles. Currently the PIPS/PIRMS model has three different phases as identified by Figure 1 (Kashiwagi 2009).



Figure 1: PIPS/PIRMS Phases

Phase 1 is a best value selection process that identifies the best value supplier through a series of five filters (Figure 2) (Kashiwagi 2012):

1. Past Performance Information - The suppliers must show satisfaction rating of projects performed for past clients.
2. Project Capability - The suppliers are required to submit three documents (project capability, risk assessment, and value added) that will be evaluated by the buyer's selection committee. The three documents must show how the supplier can deliver a high performing project through their experience and expertise, ability to foresee and mitigate risk, and ability to add value to the project.
3. Interview - The supplier's core team, that will be assigned to the project, will be questioned by the buyer's selection committee. The focus of the questioning will be to identify the team's ability to foresee and mitigate risk.
4. Prioritization - Through a weighting system and a linear model, the suppliers are ranked on their ability to deliver value.
5. Dominance Check - The buyer checks all information on the highest prioritized supplier, including their cost, to ensure there is no information that would cause the buyer to select a different supplier.

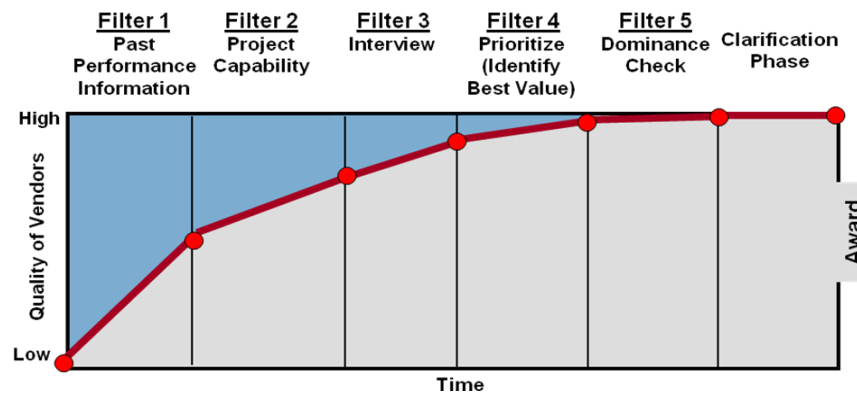


Figure 2: PIPS Filters

After Filter 5 only one supplier moves into the Clarification Phase (Phase II). The clarification period is where the contract is finalized and the supplier is required to pre-plan the entire project. At the end of Phase II the supplier is awarded the contract. Finally, in Phase III, the supplier must track all deviations that occur throughout the length of the project.

1.3.3 PIPS/PIRMS Performance

PIPS/PIRMS has also experienced the following accomplishments through its development and implementations (PBSRG 2013):

- A Construction Management Masters Degree program emphasizing the PIPS/PIRMS technology.
- 50 different clients (public & private) have participated in the testing over 17 years.
- Minimization of up to 90% of the client's professional representative's risk management efforts and transactions due to reduced risk levels and the transfer of risk and accountability to the vendors. This is the only documented reduction in management in the construction management industry.
- The results of PIPS/PIRMS testing has won the Construction Owners of America Association (COAA) Gold Award, the 2005 CoreNet H. Bruce Russell Global Innovators of the Year Award, the 2001 Tech Pono Award for Innovation in the State of Hawaii, along with numerous other awards.
- Has maximized vendor profit through efficiency, preplanning, and accountability of all parties.
- Improvement in construction educational programs and development of University curriculums.

The former procurement director and now Associated Vice-President of Arizona State University Business Services, Ray Jensen (2009), commented on PIPS/PIRMS, saying:

“I have been successful in the business of procurement and services delivery for the past 30 years. I saw in PIPS/PIRMS, improved solutions of performance/contract administration issues that are so dominant, that I am willing to change my approach to the business after 30 years” .

For more information on the performance and accomplishments of the PIPS/PIRMS, please see Appendix A in the Appendices document located at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

The PIPS/PIRMS system has been analyzed by outside groups multiple times in the last 17 years. However, there were two investigations that performed a thorough study on the impact and effectiveness of the PIPS/PIRMS system:

- The State of Hawaii Audit (Kashiwagi et al. 2002; State of Hawaii Report 2002)
- The Dutch Study on the Impact of PIPS/PIRMS (performed by Joop van Duren and Andre Doree) (2008).

These studies both confirmed that the performance claims of the PIPS/PIRMS system were accurate. Duren and Doree's study found the following for PIPS/PIRMS projects performed in the United States:

- 93.5% of clients who worked with PIPS/PIRMS identified that their projects were delivered on time.
- 96.7% of clients who worked with PIPS/PIRMS identified that their projects were delivered within budget.

- 91% of the clients stated that there were no charges for extra work.
- 93.9% of the clients awarded the supplier's performance with greater than an 8 rating (on a scale from 1-10, 10 being the highest performance rating)
- 94% of clients would hire the same supplier again.

For more information on each of these studies, please see Appendix A in the Appendices document located at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

1.4 Research Aim

PIPS/PIRMS is increasing the performance and efficiency of construction projects. This gives motivation that further research into the PIPS/PIRMS model could contribute to the development of buyer/supplier system theory.

This research focuses on the PIPS/PIRMS buyer/supplier system. The primary goal being to identify what makes the PIPS/PIRMS different from other buyer/supplier systems that have been developed. Identifying the different factors it contains, from traditional buyer/supplier systems, that could improve the customer satisfaction and value (cost, time, quality) of projects. In this research the term "traditional" will refer to all other buyer/supplier systems other than the PIPS/PIRMS model.

1.5 Scientific Contribution

The majority of research development on buyer/supplier system theory occurs in areas of purchasing/procurement and management. Next to that buyer/supplier system theory has been affected by the following research fields and concepts:

Supply Chain Management - Creating efficiency through focusing on required transactions to deliver a product or service. This can include internal transactions in an organization or external organization transactions dealing with one or more suppliers (de Ridder 2007; Olofsson et al 2010).

Transaction Cost Theory - Analyzing the interaction between organizations through economics and organizational motivation (Winch 2001). The theory identifies different conditions that will increase and decrease costs of organizations interacting. This concept has directly impacted buyer/supplier systems.

Project Management - Ensures project success through the management of internal and external, resources, workers, and organizations (Hegazy 2006). Interaction between buyer and supplier being determined by the extent to which the buyer wants to manage the project.

Outsourcing - Theories on how an organization can hire and manage other organizations to perform services that traditionally were performed internally (Davis & Davis 2012). Outsourcing is a broad topic and is connected to the other research fields (i.e. supply chain management, project management, risk management, and performance measurements).

Risk Management - Analyzing contractual agreements through potential risks that could occur from the buyer/supplier interaction. Identifying the potential impact of the risks, which party will be financially accountable for the risk, and how the risk will be handled if it occurs. Joint Risk Management (JRM) is a risk management theory that is used in buyer/supplier systems (Kumaraswamy et al. 2005).

Performance Measurement - Identifying the quality of a service being received through the measurement of key service criteria (Feurer & Chaharbaghi 1995). Interaction between the buyer and supplier being affected by how the measurement process is setup.

Quality Assurance / Quality Control - Identification of how a buyer will ensure quality on a project. Quality Assurance requiring the supplier to provide information on how the supplier ensures quality work. This is done through obtaining certifications and adhering to quality standards (Kam & Tang 1997). Quality Control requiring the buyer to ensure the quality of a supplier's work through inspection and management of the supplier (Rajendran et. al. 2012). The type and level of interaction between a buyer and supplier being determined by the degree to which the buyer would like to quality control the supplier.

None of these areas have provided factors that consistently provide efficiency and performance in buyer/supplier interaction (see Section 1.1). The purpose of this research is to identify factors that could lay a foundation for a new paradigm of interaction between buyers and suppliers.

1.6 Practical Contribution

It has been identified that the PIPS/PIRMS buyer/supplier system has been able to:

1. Decrease the amount of technical experts that a buyer needs to procure services.
2. Decrease the amount of time and cost it takes to complete projects.
3. Increase the value and innovation on projects through changing how buyers interacts with suppliers on projects.

Research identifying what factors make the PIPS/PIRMS system, will potentially help unlock the capability for organizations to perform efficient and high performing projects more easily and with less resources. Thus, allowing them to increase their productivity. This research will identify buyer/supplier interaction factors that will improve the customer satisfaction and value (in terms of cost, time, and quality) of supplier services.

1.7 Structure of Dissertation

Figure 3 identifies the structure of this dissertation. A summary of the chapters is also presented to help navigate through the chapters of the dissertation.

Chapter 1: Introduction: This chapter introduces the topic, background, purpose of the research, and the potential benefits the research will have. It creates a case for why investigation of the PIPS/PIRMS could potentially contribute to buyer/supplier system theory.

Chapter 2: Research Design/Methodology: This chapter defines the structure and methodology of the research.

Chapter 3: Buyer/Supplier Interaction Factors: This chapter reviews the difference between the traditional buyer/client system models and the PIPS/PIRMS model. The chapter describes the factors for PIPS/PIRMS success in the construction industry, based on literature.

Chapter 4: PIPS/PIRMS Factor Uniqueness and Project Impact: This chapter will show the results of a survey research, in which industry experts that have used the PIPS/PIRMS model, will identify if they are in agreement with the literature results and how they felt each unique PIPS/PIRMS factor affected the project's customer satisfaction and value.

Chapter 5: Usability and Impact on Project Success: The PIPS/PIRMS factors identified in Chapter 3 and validated in Chapter 4 will be tested on projects, in multiple industries, to see if increased customer satisfaction and value can be obtained.

Chapter 6: Conclusion: This chapter will conclude the research by summarizing the answers and results of each question identified in Chapter 2 and identifying the factors that have made the PIPS/PIRMS model to work in the construction industry and explain potential benefits of utilizing the factors in other systems.

Chapter 7: Reflection: This chapter will review the research performed, identifying its value and weaknesses. Recommendations will be given on further research.

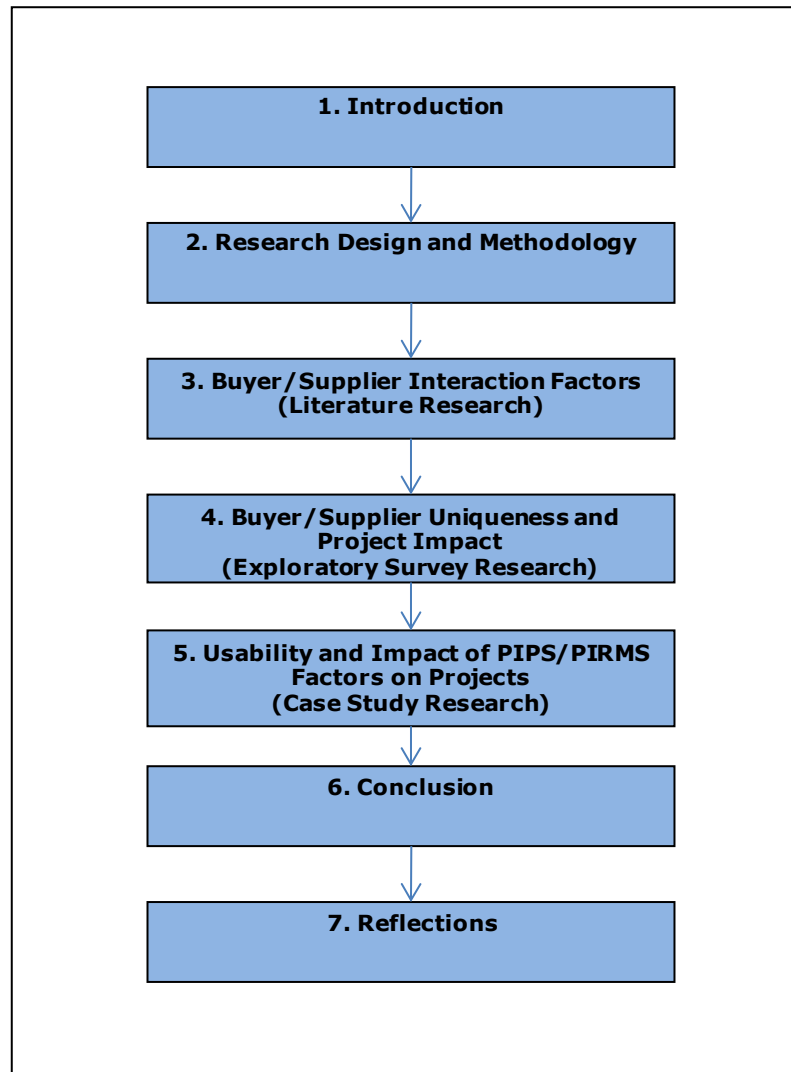


Figure 3: Structure of Dissertation

2 Research Design and Methodology

2.1 Introduction

This chapter explains the research approach; the process that is followed to contribute new knowledge in the realm of buyer/supplier interaction systems. First, the general research process is discussed. Second, the research question and sub-questions are created to help define the scope, narrow the focus, and shape the direction of the research. Thirdly, the methodology for answering the questions is laid out, identifying where the information is to be found, how the information is to be collected and analyzed, and the factors that are considered to discovering answers to the research questions.

2.2 Scope of Research

The research is focused on the interactions between a buyer and a supplier in both the public and private sectors. The research includes interactions between the buyer/supplier from the selection of a supplier until the end of project or interaction. This includes selection of a supplier, development of a contract, the realization phase, and finalization of the contract.

The research is focused on buyer/supplier systems theory to contribute to the body of knowledge on buyer/supplier systems (see Chapter 1) supported by the results of the PIPS/PIRMS process. The research looks at buyer/supplier systems from a management perspective, including the areas of transaction cost economics, supply chain management, project management, and risk management.

The research focus for this dissertation is outlined below. It entails the topic (which was also defined in Chapter 1), objectives, and the variables that are studied which define the domain of the research.

The research objective is to contribute to the development of buyer/supplier systems theory by analyzing the PIPS/PIRMS process and identifying unique factors that it uses that could improve the performance of traditional buyer/supplier systems (in terms of cost, time, and quality). In this research the term "traditional" will refer to all other buyer/supplier systems other than the PIPS/PIRMS model.

The variables that this research will be investigating are all factors involved in the interaction between the buyer and the supplier, including all activities from a buyer requesting information from vendors to the completion of a project.

Figure 4, illustrates the scope of the research focus. The purpose of this research being to identify what factors are causing the PIPS/PIRMS model to have increased customer satisfaction and value on projects than other buyer/supplier systems.

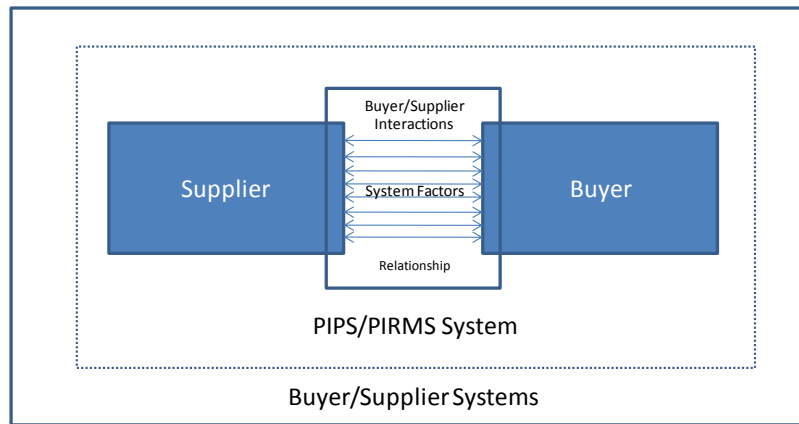


Figure 4: Buyer/Supplier Systems

The initial framework of this research is identified in Figure 5. Using academic publications and U.S. buyer documentation specific traits and actions were documented in the exact wording written in the publication and documentation, identified as "characteristics" of the systems. Then the characteristics of the systems were divided into categories called "factors". This information is used to differentiate between factors found in traditional buyer/supplier systems and factors only found in PIPS/PIRMS. As shown in Figure 5, there is expectation that there is overlap in factors that the PIPS/PIRMS system has and that of traditional buyer/supplier systems. Hence, this process helped us identify unique factors of PIPS/PIRMS that improve customer satisfaction and value of projects.

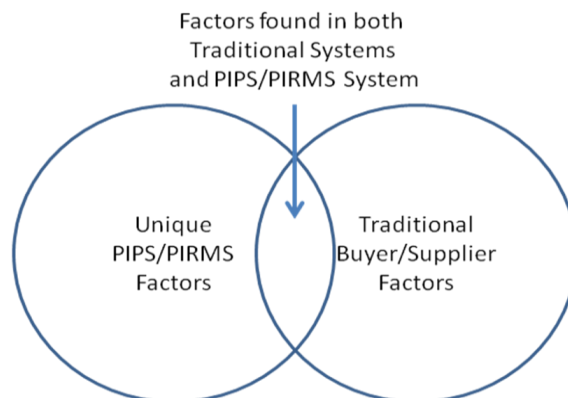


Figure 5: Initial Framework of Research

2.3 Research Questions

To ensure that the results of this research are accurate and understandable, questions have been formulated to help better define the objectives of this research. Hence, the discovered answers to the questions will be the research's contribution to the development of buyer/supplier systems.

The main research question (MRQ) is formulated as follows:

What factors in PIPS/PIRMS that are different from Traditional buyer/supplier systems could be creating increased customer satisfaction and value on projects?

The MRQ is sub divided by the following sub research questions (SRQ):

1. What factors in PIPS/PIRMS are different from traditional buyer/supplier systems?
2. Is there evidence that practitioners feel PIPS/PIRMS factors are different from other buyer/supplier systems?
3. Is there evidence that practitioners feel the unique PIPS/PIRMS factors create increased customer satisfaction (CS) and value on projects?
4. Can the unique PIPS/PIRMS factors be used on any type of project and create increased customer satisfaction (CS) and value?

The SRQs were shaped with the assumption that the greatest value in research is discovering ideas that improve society that have not currently been recognized in academics or the industry. Thus, in answering the research questions, the purpose will be to focus on the PIPS/PIRMS buyer/supplier system to identify what makes the PIPS/PIRMS different from other buyer/supplier systems that have been developed.

2.4 Research Approach

To discover answers to each of the sub-research questions different research methods have been utilized.

The methodology for this research was adapted from Dul and Hak's (Dul and Hak, 2008) structure for theory building and theory testing. The major research techniques that are used are as follows:

1. Literature Research
2. Exploratory Survey Research
3. Case Study Research

The purpose of the literature research is to "find candidate propositions for testing" (Dul and Hak 2008), which will be used to answer SRQ 1. The exploratory survey will then be used to validate the propositions and answer SRQ 2-3. The case study research will then help to answer SRQ 4.

The summarized methodology steps are below:

1. Perform literature research to identify factors of other buyer/supplier systems.
2. Identify different and overlapping factors found in the systems through analysis of literature research.
3. Validate that the factors identified in literature research through an exploratory survey.

4. Identify if the unique factors can be implemented on any type of project through case study research.
5. Identify if the PIPS/PIRMS factors created increased customer satisfaction and value on the case study projects through analysis of case study research.

The entire research design and methodology is outlined in Table 1. Each column represents a step in the research, which correlates the relationship of the methodology action, MRQ/SRQ, chapter, and variable. The first column representing the main question and methodology for answering the question.

Table 1: Methodology				
Method	Literature Research	Exploratory Survey Research	Case Study Research	Result
MRQ: <i>What factors in PIPS/PIRMS that are different from Traditional buyer/supplier systems could be creating increased customer satisfaction and value on projects?</i>				
<p>Literature search to identify unique factors.</p> <p>Exploratory Survey to identify Industry Practitioners' opinions</p> <p>Case Study research to identify if factors can be implemented on any type of project and create increased customer satisfaction (CS) and value.</p>	<i>Identify Factors in PIPS/PIRMS that are different from traditional buyer/supplier interaction systems</i>	<i>Identify if practitioners feel identified PIPS/PIRMS factors are different and if they feel the factors create increased CS and value.</i>	<i>Identify if PIPS/PIRMS factors can be used on any type of project and create increased CS and value</i>	<i>Unique PIPS/PIRMS System Factors that improve success on projects</i>
PIPS/PIRMS Model	SRQ 1 Chapter 3	SRQ 2 and 3 Chapter 4	SRQ 4 Chapter 5	MRQ Chapter 6

Literature Research

A literature review was performed identifying traditional buyer/supplier systems (Chapter 3). The search was initially focused on the construction industry, since PIPS/PIRMS was developed as a construction process.

The sources that were used to obtain this information were from books, academic journals and conference papers, industry magazines, websites, organizational documents and publications, as proposed by Dul and Hak (2008).

The purpose of the literature search is to identify factors in PIPS/PIRMS that are different from traditional buyer/supplier systems.

The method is described in greater detail in the beginning of Chapter 3.

Exploratory Survey Research

A survey research was performed, in which, the candidate population were buyers and suppliers that have had experience using the PIPS/PIRMS process as well as other buyer/supplier systems. The purpose of the survey is to identify if the literature search results are in agreement with practitioners that have implemented PIPS/PIRMS and other buyer/supplier systems in the industry. As suggested by Dul and Hak (2008) all theory building tests should be replicated to ensure validity of the results, thus, two surveys were performed to the same population. Both construction and other service industries were surveyed. The analysis compared construction survey results with the other service industries to see if there was any difference in opinion.

This method is described in greater detail in the beginning of Chapter 4.

Case Study Research

To validate if the PIPS/PIRMS factors, identified in the literature search and the industry survey, can be implemented in other industries a case study research was performed. Case study tests were performed with different public and private organizations on projects in different fields. The case study tests were measured to identify if the factors created increased customer satisfaction and value on the project. The method is described in greater detail in Chapter 5.

2.5 Research Deliverables

Through answering the research questions this research aids in the development of buyer/supplier system theory, by identifying system factors that could increase the efficiency of a buyer/supplier system.

3 Buyer/Supplier Interaction Factors

3.1 Introduction

This chapter reviews the literature research performed on traditional buyer/supplier systems and on the PIPS/PIRMS system. This includes the following steps:

1. A search for traditional buyer/supplier systems
2. Identifying system factors found in the identified traditional buyer/supplier systems.
3. Identifying system factors found in the PIPS/PIRMS system.
4. Analysis between the traditional buyer/supplier systems' factors and the PIPS/PIRMS system's factors.
5. Conclusions

The purpose of this literature search is to answer SRQ 1 (Chapter 2): What factors in PIPS/PIRMS are different from traditional buyer/supplier systems. The literature research will be focused on the construction industry.

The following sections of this chapter will review each of the literature search steps and explain the methodology used to carry out and complete each step.

3.2 Literature Research Methodology

Figure 6 depicts how the search for unique PIPS/PIRMS factors was performed.

First, literature for traditional buyer/supplier systems were found in two areas, literature on U.S. Buyer systems (top of Figure 6) and academic publications on buyer/supplier systems (far left of Figure 6). Then a literature search for PIPS/PIRMS was performed searching academic publications that have been published (far left of Figure 6).

From the academic publications for both PIPS/PIRMS and traditional buyer/supplier systems, a list of major theories were identified. Another literature search was then performed looking for academic publications on each theory identified (mid section of Figure 6). The reference that identified each theory can be found in Appendix B of the Appendices document at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

All academic publications and U.S. Buyer system documentation identified specific traits and actions of the system being documented or discussed. Those specific traits and actions were documented in the exact wording written in the publication and documentation it was found in, and are identified as "characteristics" of the systems (end section of Figure 6).

Academic Literature

Industry Literature

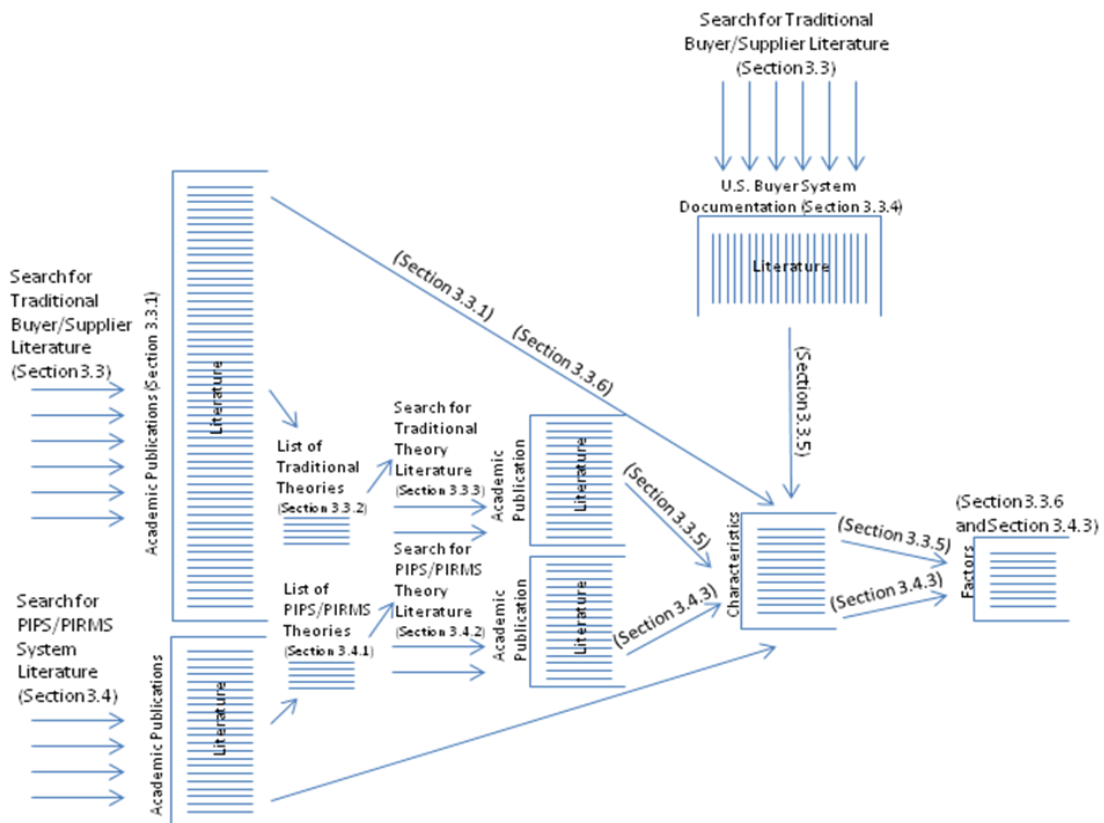


Figure 6: Literature Research Methodology

When all the literature was reviewed and all characteristics were identified, the researcher then took all the characteristics and divided them into categories called factors. A factor will be identified as a category that the researcher created (far right or last step in Figure 6). The complete documentation of combining characteristics into factors can be found in the Literature Research Information document on the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

The factors were then divided as shown in Figure 7. The factors that were unique to PIPS/PIRMS were then separated from the rest of the factors.

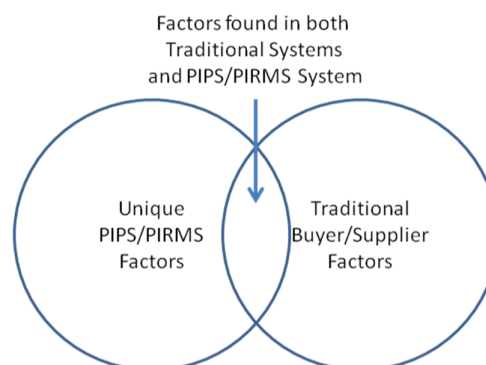


Figure 7: PIPS/PIRMS Factors

The rest of this chapter explains the details of each step performed and how the methodology was carried out.

3.3 Traditional Buyer/Supplier Perspectives

To identify the most relevant traditional buyer/supplier systems to include in this research the author used the following information sources:

- Academic search engines
- U.S. buyers documentation

To ensure that the search was organized and effective in identifying all available documented information on construction buyer/supplier systems the following procedure and parameters were setup and followed:

1. Keyword and database searching
2. Searching and filtering through literature
3. Documentation of Information

The following sections review each procedure in detail.

Keyword and Database Searching

The author wanted to keep the searches as broad as possible to minimize the chances of missing a buyer/supplier system. The author used the main scientific arenas and industry professions as the search terms:

- Construction Supply Chain Management
- Construction Project Management
- Construction Outsourcing
- Construction Procurement
- Construction Purchasing
- Construction Risk Management
- Construction Performance Information
- Construction Quality Assurance
- Construction Quality Control
- Construction Contract Management
- Construction Transaction Cost Economics

These keywords were used and searched in academic search engines available to ensure that as much relevant information on construction buyer/supplier systems could be found. The main search engines that were used in this study were EI Compendex, Emerald Journals, ABI/Inform, and Scholar Google. A description of each of the search engines is given:

- EI Compendex -
 - Has over 10 million records from more than 5,600 scholarly journals, trade magazines and conference proceedings.

- Contains academic writings dating from the present back to 1969.
- More than 650,000 records are added annually to the database and more than 5,600 academic journals and conference proceedings are indexed annually.
- The database is updated weekly with articles spanning 190 engineering disciplines in 55 different countries.

- Emerald Journals -
 - Has more than 190 academic journals
 - It maintains a database with articles from multiple construction related areas such as: facilities management, engineering management, and construction management.

- ABI/Inform -
 - This was relied on as the major search engine for the literature search.
 - Contains more than 1,100 English-language journals and publications.
 - The publications come from the entire globe and focuses on business and management.
 - Some of the major publications that were focused on this research include: Journal of Facilities Management, Engineering News Record, Journal of Construction Engineering and management, Cost Engineering, American Association of Civil engineers International Transactions, International Journal of Project Management, Engineering, Construction, and Architectural Management

- Scholar Google -
 - This search engine contained all academic publications that were available on the internet.
 - The only publications the author could utilize were those available at no cost.
 - Due to the vast amount of information that would be brought up, only the top 300 articles were reviewed.

The terms that were searched via the search engines during the initial literature search are shown in Table 2. Table 2 also documents the following information:

- The number of hits provided by each search (this is found in the column with the search engine's name).
- The number of relevant articles to this research effort (this is found in the hits columns).
- The year touched for each search term. (This is the year of the oldest article reviewed. Articles were reviewed in chronological order, beginning with the newest articles).
- The total number of relevant articles looked into. (Total hits).

Table 2: Key Word Search Log

Search Term (click the links below to take you to term)	E Compendix	Hits	Year touched	Emerald Journals	Hits	Year touched	ABI/Inform	Hits	Year touched	Google Scholar	Hits	Year touched	ASCE Library	Hits	Year touched
Construction Supply Chain Management	1079	58	2003	2516	63	2001	103	14	2007	693000	5	1999	16	2	2010
Construction Project Management	23582	66	1983	12646	34	1994	1006	3	2006	2060000	7	2001	107	11	2010
Construction Outsourcing	454	79	1993	1221	8	2002	22	3	1997	60900	11	2001	4	2	2010
Construction Procurement	2157	66	1951	1780	13	1998	125	6	1979	49900	11	1997	34	3	2010
Construction Purchasing	2147	13	1978	2956	7	1995	56	3	1978	162000	9	2000	5	0	2010
Construction Risk Management	2924	62	1988	7143	8	1998	97	6	1982	871000	8	1994	45	5	2010
Construction Performance Measurement	13048	37	1980	5165	7	1994	472	4	1996	2540000	23	1987	6	3	2010
Construction Quality assurance	2140	8	1972	1608	13	1994	556	3	2001	343000	10	1995	10	1	2010
Construction Quality Control	6260	4	1994	9078	1	1996	50	3	1978	2690000	18	1998	17	1	2010
Construction Contract Management	5199	6	1884	4161	2	1994	23,281	16	1987	196000	3	2001	2836	5	2010
Construction Transaction Cost Economics	538	3	2009	1623	8	2007	16,829	2	2009	196,000	5	1996	321	8	1990
Total Hits -->		402			164			63			110			41	780

The literature review and research effort was affected by two major constraints: a language barrier and access to articles. The first constraint was created by a language barrier, which was experienced by those conducting the search. The literature review was conducted entirely in English, as it is the only language the researcher was fluent in. Therefore, the findings included only literature that was originally presented in English or had been translated to English from another language. The second constraint was the author only searched for articles using academic databases available. Thus, some articles were overlooked due to not being able to access them.

Searching and Filtering Through Literature

Relevant publications were found by reading the abstract of every publication the search engine brought up to the year identified in Table 2. In total, there were 780 papers found related to the research topic. The 780 papers were then reviewed in more detail to identify if it could be used for the research. All publications that were related to buyer/supplier systems were kept and used for the study. After the filtering took place the author had found 79 articles that related directly to the research topic.

After finding the 79 relevant articles, an in depth search was conducted in order to locate the relevant articles that were identified as references in the articles returned by the search engines. Articles that were published after 2005 were searched for, as the intent was to ensure the researcher did not miss any new developments to buyer/supplier systems. To find the referenced articles, the same four search engines were employed, and additional search engines like, Illiad interlibrary service, ProQuest, ScienceDirect, ASCE Library, and Informaworld. Although Scholar Google was not an effective tool for the initial literature review, it was incredibly effective at locating single articles that were searched for using bibliography listings. If the search engines were unable to provide access to an article then direct searches for the referenced articles were conducted. Direct searches consisted of going directly to the source publications of the articles referenced. An additional 181 articles were found through this process. Out of the 181 articles it was found that 16 of the papers were duplicates and 24 were relevant to the research topic.

3.3.1 Identifying Characteristics of Traditional Buyer/Supplier Systems

The researcher's original plan was to take the identified traditional buyer/supplier systems and use the publications to identify the characteristics of the system. The author came into two problems with this method:

- Author(s) of some articles would use parts of multiple buyer/supplier systems to come up with their own unique buyer/supplier system.
- Author(s) of articles would interpret the same buyer/supplier system differently.

It was decided that the most accurate way to identify characteristics of buyer/supplier systems was to identify each article as a different system. The characteristics found in the publication would then be the characteristics of that buyer/supplier system.

All publications that were found in the academic literature search were reviewed to find characteristics of the buyer/supplier system described in the publication. The researcher documented the exact wording from each publication for each characteristic that was identified. The researcher also documented theories identified in the publications that helped to develop the buyer/supplier system discussed. Literature on those theories were also looked up to identify if the theory had any additional characteristics that the system missed.

The entire list of characteristics can be in the document Literature Research Information, which can be found at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

3.3.2 List of Theories

In searching the academic publications for characteristics, the publications also identified buyer/supplier theories that helped develop the system identified in the publication. The following Buyer/Supplier theories were identified after reviewing all the traditional buyer/supplier publications:

1. Lean Construction
2. Transaction Cost Economics
3. Principle Agent Theory
4. Partnering
5. Supply chain management
6. Value stream analysis
7. Reliable Commitment Model
8. Conflict Management
9. Dispute Avoidance and Resolution Techniques
10. Balanced Score Card
11. Joint Risk Management
12. Total Quality Management
13. New Institutional Economics
14. Capability Maturity Model
15. Just In Time (JIT)
16. Nominal Group technique
17. Risk Management Practices
18. Construction Management at Risk
19. Public Private Partnership
20. Project Management Body of Knowledge (PMBOK)
21. Relational Contracting

3.3.3 Search for Traditional Theory Literature

Another literature search was performed identifying academic publications on each of the identified buyer/supplier theories. The publications were then used to find additional buyer/supplier characteristics (see mid section of Figure 6). Appendix B in the document Appendices gives a brief explanation of each theory. The characteristics identified from the theory publications can be found in the Literature Research Information found at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

3.3.4 U.S. Buyer System Documentation

The next step in searching for literature on traditional buyer/supplier systems was to look for actual U.S. buyer systems that were being implemented in organizations (see top of Figure 6). This research focused on U.S. buyers that had run PIPS/PIRMS, so that a comparison of both processes could take place.

The buyers were identified by the following criteria:

- The buyers had to have run PIPS/PIRMS.
- The organization had to have literature on their buying process.
- Public and private entities.
- Large buying organizations (# of People, \$ Purchased, etc.).
- Different types of government organizations (Federal, State, City, PPP).
- Organizations in different locations in the United States.
- The organization had to be purchasing construction services.
- Organizations that also purchased other services

From the above criteria, the following organizations were selected:

- State of Oklahoma
- MEDCOM
- Arizona State University
- United State Corps of Engineers
- Schering Plough (Merck & Co.)
- NJ Port Authority
- Entergy / Cushman and Wakefield
- State of Alaska
- United States General Services Administration (GSA)
- University of Minnesota

For more information on the selection of each organization please see the Literature Research Information document found at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

After the organizations were identified, characteristics for each organization's buyer/supplier system were collected. The literature used for this were as follows:

- Request for Proposals of the buying organization
- Project management documents
- Policy manuals

3.3.5 Traditional Buyer/Supplier System Characteristics and Factors

After documenting the characteristics from:

- Buyer/Supplier systems documented by 103 academic publications
- Supporting buyer/supplier theories found in the documented buyer/supplier systems
- 10 U.S. Buyers' buyer/supplier systems.

The characteristics were compiled. There were 919 traditional characteristics identified from the literature search. Due to the amount of characteristics identified, a full list is not found in this document. The full list of characteristics can be found in the Literature Research Information document at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

The researcher found that although characteristics were worded differently, many of the characteristics were similar to each other. In order to make the characteristics easier to compile and analyze, the researcher took all of the characteristics and categorized them into major actions and areas of focus called factors.

After reviewing all the characteristics there were 36 factors created. The characteristics that created each factor can also be found in the Literature Research Information document at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>

These 36 factors are listed below with a short description of each factor:

1. Planning
The system emphasizes that thorough planning after a contract award can help improve the efficiency and performance of a project.
2. Communication
The system promotes the buyer and the supplier to share more information and communicate with each other more (i.e. Meetings, Reports, Access to internal technical information, etc.) The buyer/supplier also tries to improve efficiency by increasing information flow.
3. Collaboration and partnering
The system increases the amount of activities, information flow, and idea sharing between the buyer and the supplier before the contract is signed and throughout the entire project.
4. Shared accountability
The system allows for both the buyer and the supplier to make decision on the project. The buyer agreeing to take partial responsibility for the project outcome.
5. Trust
The system requires the buyer and the supplier to assume that the other party will hold to the agreement and is capable to perform their requirements.

6. Multi-Disciplinary Team
The buyer creates a team of experts from many different disciplines to interact with the supplier. This team will begin communication with the supplier as soon as they are selected.
7. Early Supplier Involvement
The system will bring in the supplier at the beginning of the creation of the project. It will allow the supplier to be involved in the creation of the scoping and the purpose of the project.
8. Senior/Top Management Support
The system focuses on gaining support of either or both the suppliers and the buyers upper level management to support the project and have them involved throughout the project to help with coordination and participation.
9. Contract Terms
The system identifies project success with the shaping of the contract. The system presenting strategies for creating contracts and identification of contract terms that improve the project.
10. Long-term contracts/relationships
The system increases efficiency of the project through advantages in lengthening the time of contractual obligations of a supplier or through continually using the same suppliers. Some of the advantages in this are knowledge retention and standardization of interactions and processes.
11. Defining Roles
The system focuses on identifying authoritative boundaries of both buyer and supplier personnel. It also puts an emphasis on ensuring everyone knows their roles and responsibilities.
12. Living Scope
The system allows the scope of work to be molded as the project is being implemented. This also entails creating a contract that can easily be modified.
13. Scope of Service
The buyer and the supplier focus on detailing the scope for a project before the contract is signed to improve performance.
14. Incentives and Penalties
The buyer and supplier have terms in the contract that gives either party a monetary award or penalty for performing a certain action.
15. Use Information to Make Decisions

The buyer or supplier collects information on the project during the project and is using the information to make decisions throughout the project.

16. Measurement tools

The buyer or supplier has a tool or process that measures their performance of the project in any manner.

17. Insurance and bonds

System requires the supplier to have insurance or bonds to ensure the project is completed to the buyer's satisfaction.

18. Document Structure

The buyer has created a system the requires the supplier to complete documents and forms to ensure the project is meeting expectations.

19. Training Program

Some type of training is provided to both the buyer and supplier employees working on the project to increase performance and efficiency.

20. Stakeholder Management

The System identifies that involvement of all buyer stakeholders helps to increase project performance and efficiency.

21. Delegate Responsibility

The system tries to push decision making down the management chain on both the supplier and buyer's side to increase efficiency of the project.

22. Knowledge Management System

The buyer or supplier keeps track of lessons learned throughout the project and has a way to inform workers of the information to increase project performance.

23. Inspection

The system has a party inspecting the supplier's technical work.

24. Buyer Decision Making

The buyer is the party in control of the project and makes most of the decisions.

25. Buyer Performance Evaluation

The buyer's representatives identifies if the supplier is performing or not. The supplier performance does not come from performance information, documentation, or any third party.

26. Third Party Certification

The buyer requires the supplier to obtain some type of certification or pass any type of third party inspection.

27. Risk Sharing
The buyer and the supplier take accountability to mitigate the risks that occur and take part of the liability if the risk does occur.
28. Project Constraints
System identifies project constraints at the beginning of a project to help project management.
29. Mitigation of Technical Risk
The system focuses on improving project performance through managing risks that involve the suppliers' expertise.
30. Computer Algorithm
System uses a computer algorithm (AHP, Fuzzy Logic) to make decisions
31. Simulation Technology
The system uses a simulation technology to increase project performance.
32. Internal Technology Connection
The system looks to integrate the internal communication technology systems of the buyer and the supplier to increase efficiency and the ability to transfer information.
33. Master Supplier
The system allows the buyer to hire one supplier for many types of services. The supplier is able to subcontract work, but the buyer will not need to enter a contractual relationship with multiple suppliers.
34. Experienced Project Manager / Facilitator / Supply Chain Integrator
The system has the buyer hire or maintain in-house experts that will be the representative(s) for the buyer in managing the project.
35. Quality Surveyor
The system hires a quality surveyor or quality assurance inspector to ensure that the supplier is meeting the standards and requirements of the contract.
36. Information Communication Technology
The system uses any type of information communication technology to aid in communication on the project. This includes using any type of software, the internet, or other devices.

3.3.6 Traditional Buyer/Supplier Factors

Table 3 shows the three different sections of the literature search (academic publications for buyer/supplier systems, academic publications for buyer/supplier theories, and U.S. Buyer documentation) and all of the 36 factors identified. The percentage in each box represents the number of times the factor was found in the different sections of the literature search. Thus, the "Planning" factor appeared in 17 percent of all the academic publications researched, it also appeared in 67 percent of all the traditional buyer/supplier theories researched, and in 50 percent of the U.S. Buyers buyer/supplier systems that were researched.

Table 3: Comparison of % Each Factor was Found in the Different Sections

#	Factors	Traditional Buyer/Supplier systems (Academic Papers)	Theories	10 U.S. Buyers
1	Planning	17%	67%	50%
2	Communication	52%	57%	80%
3	Collaboration and Partnering	59%	67%	40%
4	Shared Accountability	24%	38%	0%
5	Trust	34%	33%	0%
6	Multi-Disciplinary Team	12%	14%	10%
7	Early Supplier Involvement	13%	19%	0%
8	Senior/Top Management Support	15%	19%	10%
9	Contract Terms	22%	43%	70%
10	Long-term contracts/relationships	27%	33%	10%
11	Defining Roles	8%	5%	50%
12	Living Scope	2%	10%	0%
13	Scope of Service	2%	19%	80%
14	Incentives and Penalties	25%	43%	30%
15	Use Information to make decision	19%	43%	20%
16	Measurement Tools	35%	52%	50%
17	Insurance and bonds	3%	10%	70%
18	Document Structure	9%	43%	70%
19	Training Program	15%	14%	40%
20	Stakeholder Management	6%	19%	20%
21	Delegate Responsibility	8%	24%	0%
22	Knowledge Management System	9%	24%	10%
23	Inspection	15%	14%	90%
24	Buyer Decision Making	7%	14%	80%
25	Buyer Performance Evaluation	11%	14%	80%
26	Third Party Certification	8%	10%	30%
27	Risk Sharing	20%	43%	0%
28	Project Constraints	5%	33%	0%
29	Mitigation of Technical Risk	13%	19%	30%
30	Computer Algorithm	7%	29%	0%
31	Simulation Technology	2%	5%	10%
32	Internal Technology Connection	16%	5%	10%
33	Master Supplier	4%	5%	50%
34	System hires an Experienced Project Manager/Facilitator/Supply Chain Integrator	9%	14%	80%
35	Quality Surveyor	2%	10%	60%
36	Information Communication Technology	24%	29%	50%

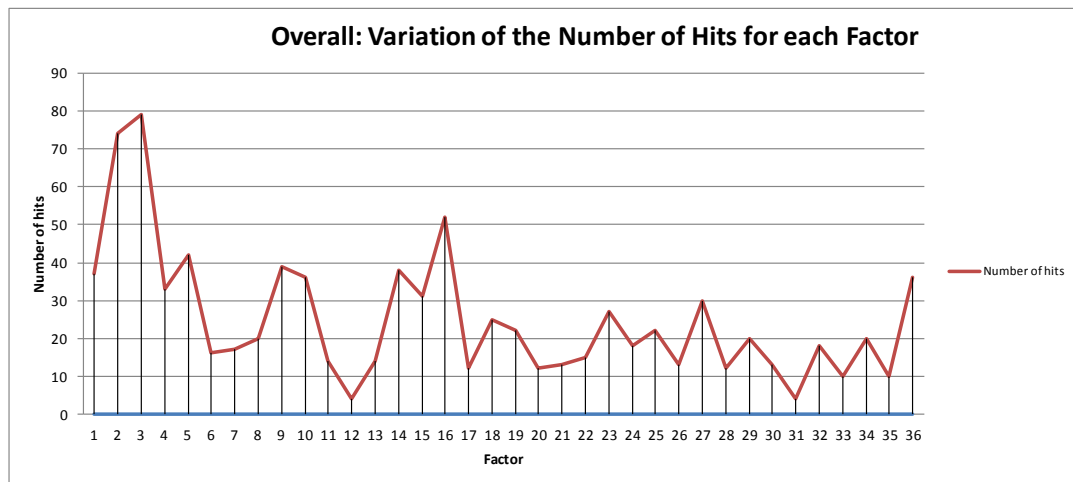
Both the academic buyer/supplier systems and the theories had identified all of the factors to some degree. The U.S. Buyer systems however did not use 8 factors that were identified in the other two areas. These factors were:

- Shared Accountability
- Trust
- Early Supplier Involvement
- Living Scope
- Delegate Responsibility
- Risk Sharing
- Project Constraints
- Computer Algorithm

Even though the above 8 factors were not found in U.S. Buyer systems, does not mean, these U.S. Buyers do not utilize those factors. There was no documentation found by the researcher to indicate the buyers do use them.

The following four graphs show the results of a comparison between each factor and the amount of times the factor was referenced in terms of:

- The overall research results (academic papers, theories and U.S. Buyer) (Figure 8)
- Academic paper results (Figure 9)
- Academic theory results (Figure 10)
- U.S. Buyer results (Figure 11)



**Figure 8: Overall Research Results
(Academic papers, Academic Theories, and U.S. Buyers)**

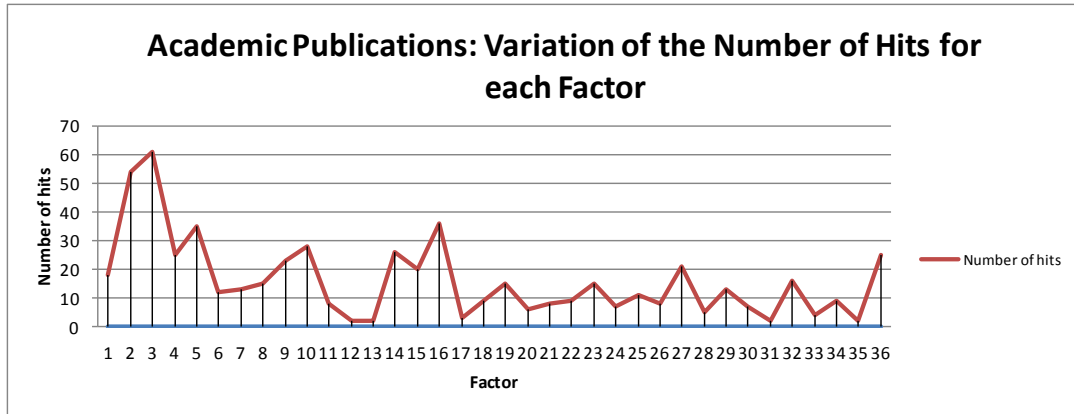


Figure 9: Academic Publication Results

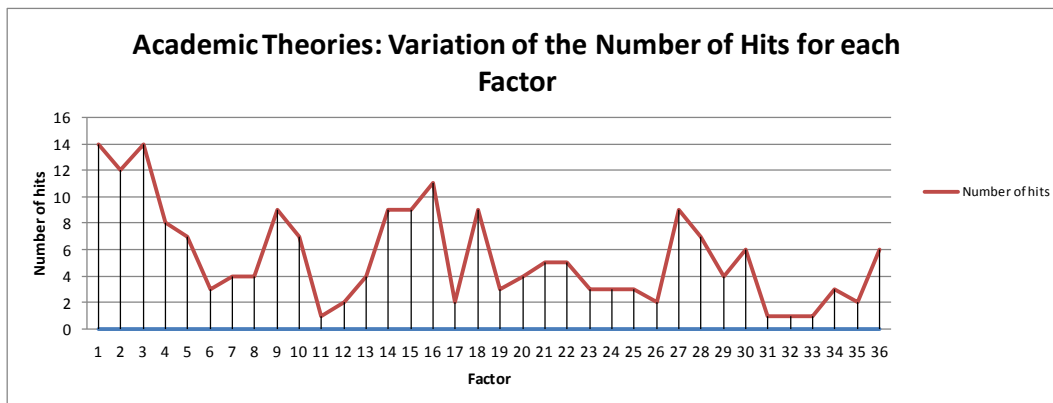


Figure 10: Academic Theories Results

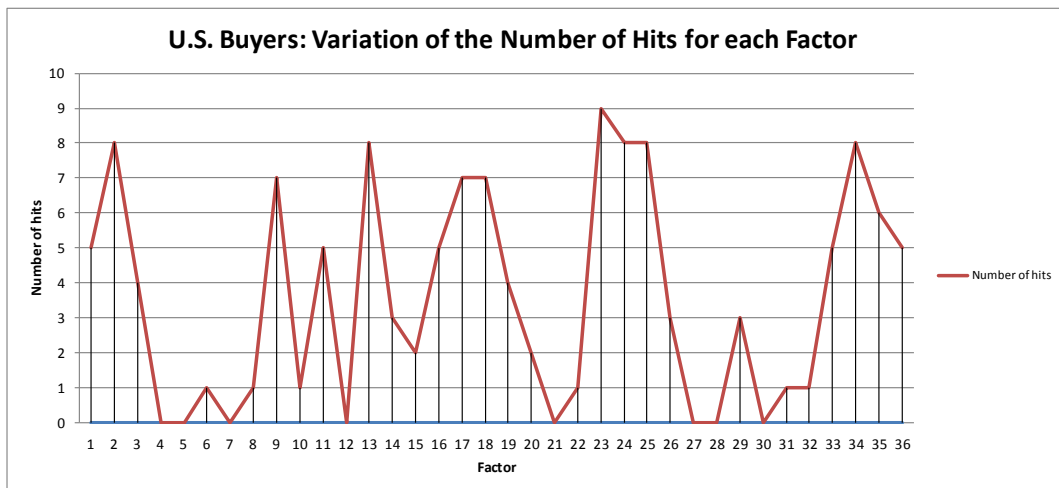


Figure 11: U.S. Buyer Results

Figure 8-11 identifies differences between the different literature on traditional buyer/supplier systems. The following are major observations from the traditional literature search:

- Since most of the literature was found in Academic Papers (Figure 9), the overall results (Figure 8) reflect the academic publication's table.

- The major difference between the theory literature and the paper literature is the factor of "Planning". The theory literature felt it was very important, however, the academic papers did not emphasize it as much.
- The U.S. Buyer system documentation was the most consistent of all the traditional literature sources. This can be seen by the extreme value of the factors. Identifying that either most of the buyers used the factor or did not use the factor.

3.4 PIPS/PIRMS Factors

After the factors for the traditional buyer/supplier systems were identified, the next step in the research was to identify the factors found in the PIPS/PIRMS system.

The PIPS/PIRMS has had many publications written about its development, process, and implementations, over the last 17 years. PIPS/PIRMS factors were identified from the following different types of publications:

- Books
- Journal and Conference Publications
- Government Reviews on the PIPS/PIRMS process.

The Performance Based Studies Research Group has a database of all published works that have been written on the PIPS/PIRMS system. The database has the following characteristics:

- The database is updated every month to ensure all recent publications are included.
- The database contains more than 200+ articles on the PIPS/PIRMS system.
- The database includes articles from more than 70+ authors that have written on the PIPS/PIRMS system.
- The database includes all government reviews and reports on the PIPS/PIRMS system.

All of the publications in the PBSRG database were reviewed for this research. The literature search found 19 publications that were used to develop the characteristics for the PIPS/PIRMS buyer/supplier system.

A description of the PIPS/PIRMS process can be found in Chapter 1 and in Appendix B of the Appendices document found at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

3.4.1 List of PIPS/PIRMS Theories

In searching the academic publications for PIPS/PIRMS characteristics, the publications also identified buyer/supplier theories that helped develop the PIPS/PIRMS. The following theories were identified that helped to contribute to PIPS/PIRMS (Kashiwagi, 2012):

- Information Measurement Theory
- Kashiwagi Solution Model
- Construction Industry Structure (CIS)
- Alignment Leadership Model (ALM)

3.4.2 Search for PIPS/PIRMS Theory Literature

The PBSRG database was used to perform additional literature research on each of the above-identified theories. Twenty publications were found that defined each of these theories and identified characteristics of the PIPS/PIRMS. The description of the theory and how it affects the PIPS/PIRMS can be found in the Appendices document found on the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

3.4.3 PIPS/PIRMS Characteristics and Factors

The literature research on the PIPS/PIRMS and the PIPS/PIRMS theories found 39 publications. These publications found 54 buyer/supplier characteristics. All the characteristics can be found in the Literature Research Information document at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

Due to the similarity of many of the PIPS/PIRMS characteristics, like the traditional buyer/supplier characteristics, they were then combined and summarized into Factors. Some of the factors were already identified by the Traditional Buyer/Supplier literature search, and some factors were new.

All of the factors that are related to the PIPS/PIRMS are found in Table 4.

Table 4: Findings of PIPS/PIRMS Factors

#	Factors	PIPS/PIRMS
1	Planning	100%
2	Communication	0%
3	Collaboration and Partnering	0%
4	Shared Accountability	0%
5	Trust	0%
6	Multi-Disciplinary Team	0%
7	Early Supplier Involvement	0%
8	Senior/Top Management Support	0%
9	Contract Terms	0%
10	Long-term contracts/relationships	0%
11	Defining Roles	0%
12	Living Scope	0%
13	Scope of Service	0%
14	Incentives and Penalties	0%
15	Use Information to make decision	0%
16	Measurement Tools	100%
17	Insurance and bonds	0%
18	Document Structure	100%
19	Training Program	100%
20	Stakeholder Management	0%
21	Delegate Responsibility	100%
22	Knowledge Management System	0%
23	Inspection	0%
24	Buyer Decision Making	0%
25	Buyer Performance Evaluation	0%
26	Third Party Certification	0%
27	Risk Sharing	0%
28	Project Constraints	0%
29	Mitigation of Technical Risk	0%
30	Computer Algorithm	0%
31	Simulation Technology	0%
32	Internal Technology Connection	0%
33	Master Supplier	0%
34	System hires an Experienced Project Manager/Facilitator/Supply Chain Integrator	0%
35	Quality Surveyor	0%
36	Information Communication Technology	100%
37	No-influence, no-control, no management philosophy	100%
38	Seamless contract	100%
39	Supplier contract creation	100%
40	Pre-planning	100%
41	Problem Contracting	100%
42	Communication Minimization	100%
43	Expert Supplier Model	100%
44	Dominant Information	100%

The process of combining PIPS/PIRMS characteristics into a set of factors can be found in the Literature Research Information document at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

3.5 Unique PIPS/PIRMS Buyer/Supplier Factors

As identified in section 3.2, Figure 7, after the literature research was performed and factors were identified for both the traditional buyer/supplier systems and the PIPS/PIRMS, the researcher then identified which factors were found in both groups and which factors were unique to each group. Table 5 shows all the factors identified and the unique factors to the PIPS/PIRMS.

Table 5: Comparison of Traditional vs. PIPS/PIRMS Factors

#	Factors	Traditional Buyer/Supplier systems (Academic Papers)	Theories	10 U.S. Buyers	PIPS/PIRMS
1	Planning	17%	67%	50%	100%
2	Communication	52%	57%	80%	0%
3	Collaboration and Partnering	59%	67%	40%	0%
4	Shared Accountability	24%	38%	0%	0%
5	Trust	34%	33%	0%	0%
6	Multi-Disciplinary Team	12%	14%	10%	0%
7	Early Supplier Involvement	13%	19%	0%	0%
8	Senior/Top Management Support	15%	19%	10%	0%
9	Contract Terms	22%	43%	70%	0%
10	Long-term contracts/relationships	27%	33%	10%	0%
11	Defining Roles	8%	5%	50%	0%
12	Living Scope	2%	10%	0%	0%
13	Scope of Service	2%	19%	80%	0%
14	Incentives and Penalties	25%	43%	30%	0%
15	Use Information to make decision	19%	43%	20%	0%
16	Measurement Tools	35%	52%	50%	100%
17	Insurance and bonds	3%	10%	70%	0%
18	Document Structure	9%	43%	70%	100%
19	Training Program	15%	14%	40%	100%
20	Stakeholder Management	6%	19%	20%	0%
21	Delegate Responsibility	8%	24%	0%	100%
22	Knowledge Management System	9%	24%	10%	0%
23	Inspection	15%	14%	90%	0%
24	Buyer Decision Making	7%	14%	80%	0%
25	Buyer Performance Evaluation	11%	14%	80%	0%
26	Third Party Certification	8%	10%	30%	0%
27	Risk Sharing	20%	43%	0%	0%
28	Project Constraints	5%	33%	0%	0%
29	Mitigation of Technical Risk	13%	19%	30%	0%
30	Computer Algorithm	7%	29%	0%	0%
31	Simulation Technology	2%	5%	10%	0%
32	Internal Technology Connection	16%	5%	10%	0%
33	Master Supplier	4%	5%	50%	0%
34	System hires an Experienced Project Manager/Facilitator/Supply Chain Integrator	9%	14%	80%	0%
35	Quality Surveyor	2%	10%	60%	0%
36	Information Communication Technology	24%	29%	50%	100%
37	No-influence, no-control, no management philosophy	0%	0%	0%	100%
38	Seamless contract	0%	0%	0%	100%
39	Supplier contract creation	0%	0%	0%	100%
40	Pre-planning	0%	0%	0%	100%
41	Problem Contracting	0%	0%	0%	100%
42	Communication Minimization	0%	0%	0%	100%
43	Expert Supplier Model	0%	0%	0%	100%
44	Dominant Information	0%	0%	0%	100%

It was found that only 8 factors were unique to PIPS/PIRMS. The following are explanations of each unique PIPS/PIRMS factor identified:

- No-Influence, No Control, No Management philosophy - PIPS/PIRMS gets the buyer to minimize direction and release control over the supplier, since the supplier is the expert. This system also focuses on making the supplier accountable for the project, due to the owner minimizing direction and decision making on the project.
- Seamless Contract - Contract mitigates risk instead of being a legal/regulatory/control document.

- Supplier Contract Creation - The supplier creates the contract and the scope of the project.
- Pre-planning - The PIPS/PIRMS places more importance on pre-planning before the contract is signed then after the contract is signed. The contract representing the start or implementation of the service, since usually the contract binds all parties to an identified project plan and set of activities.
- Problem Contracting - PIPS/PIRMS does not require the buyer to identify the scope of the project. Allowing the buyer to only relay their intent and expectations.
- Communication Minimization - System minimizes buyer/supplier communication
- Expert Supplier Model - Supplier has no technical risk and focuses on mitigating risk the supplier does not control
- Dominant Information - Communication to be in simple, clear, and in non-technical terms.

Factors were found to be unique because they could not be found in any other buyer/supplier systems. When compared to the traditional buyer/supplier factors, none of the factors could be matched up with a traditional factor.

3.6 Conclusion

The literature research found 44 buyer/supplier factors, 8 of which are unique to PIPS/PIRMS:

- No-influence, no-control, no management philosophy
- Seamless contract
- Supplier contract creation
- Pre-planning
- Problem Contracting
- Communication Minimization
- Expert Supplier Model
- Dominant Information

The identified 8 unique PIPS/PIRMS factors answers the first Sub-Research Question: *What factors in PIPS/PIRMS are different from traditional buyer/supplier systems.*

The research also found that there were five factors that both the traditional systems and the PIPS/PIRMS system utilized:

1. Planning
2. Measurement Tools
3. Training Program
4. Project Constraints
5. Information Communication Technology

Some of the major observations discovered regarding the difference between these unique PIPS/PIRMS factors and the traditional buyer/supplier model factors were:

- No other system identified that the buyer should release all control mechanisms (i.e. contracts, rules, requirements, oversight, etc.) and minimize their management of the supplier.
- No other model required the supplier to have a plan before contract signing, mitigate risk they did not control, and use the contract as the mechanism to protect the supplier and minimize risk for the buyer.
- No other model focuses on eliminating the sharing of technical details with the client, and force all information to be dominant (i.e. simple, clear, succinct, etc.)

The closest factors to the PIPS/PIRMS model that the traditional systems identified were:

- The act of trying to minimize problems and inefficiencies through planning. This was not found in the construction realm, but was found in the business industries, stemming from the supply chain management and manufacturing industries (JIT and Lean).
- Having a way to measure the performance of a project. The literature search revealed that academics, U.S. Buyers, and PIPS/PIRMS, all realize the importance of performance measurement.

In conclusion, there are 8 PIPS/PIRMS factors. The next step in this research will now be to turn to the industry and find their opinion on the PIPS/PIRMS system compared to traditional buyer/supplier systems.

4 PIPS/PIRMS Factors Uniqueness and Project Impact

4.1 Introduction

In Chapter 3, the following buyer/supplier interaction factors were identified as unique to the PIPS/PIRMS buyer/supplier model:

- No-influence, no-control, no management philosophy
- Seamless contract
- Supplier contract creation
- Pre-Planning
- Problem Contracting
- Communication Minimization
- Expert Supplier Model
- Dominant Information

This chapter focuses on the opinion of industry practitioners to validate the uniqueness of the 8 factors that were identified from the literature research results (see Chapter 2, SRQ 2). This chapter also seeks to identify how practitioners feel the eight factors affect the customer satisfaction and value (cost, time, quality) of a project (see Chapter 2, SRQ 3). The opinion of practitioners was collected through two exploratory surveys conducted in 2011 and 2012. The results of the surveys provided support and justification for further investigation into the impact of the unique PIPS/PIRMS factors on buyer/supplier systems.

This chapter is outlined as follows:

- 4.2 Exploratory Survey Methodology
- 4.3 2011 Exploratory Survey Results
- 4.4 2012 Exploratory Survey Results
- 4.5 Comparison of Surveys 2011 and 2012
- 4.6 Conclusion

4.2 Exploratory Survey Methodology

Both of the surveys (2011 and 2012) were conducted at the Annual Best Value Conference held in Tempe, Arizona. This conference attracted over 200 practitioners each year for the last 3 years. Since there are not many PIPS/PIRMS users these 200 practitioners would be the main population of practitioners that could fill out a survey on both PIPS/PIRMS and on traditional buyer/supplier systems. The annual conference also attracts many PIPS/PIRMS users from not only the United States, but also from the Netherlands and Canada, two countries that also have multiple practitioners interested in PIPS/PIRMS. This broadened the primarily U.S. focus until now.

At the beginning of each survey, the following general information questions were asked:

- Name
- # of years having implemented PIPS/PIRMS
- Type of organization

Both surveys (2011 and 2012) were divided into two sections:

- PIPS/PIRMS Factors - Statements relating to the PIPS/PIRMS factors and their impact on project performance were given. Instead of using the PIPS/PIRMS factor's, the researcher decided to use some of the actual characteristic wording of each factor to improve the understandability of the survey to the practitioners. The questionnaire describe each of the 8 PIPS/PIRMS factors (using the wording from characteristics that made up the factor) and then stated that the factor was unique and had impact on project performance. The practitioner then had to identify if they agreed, did not know, or disagreed. This was done with a 1-10 rating system: 1-4=disagree, 5= not enough information to know (don't know), and 6-10=agree.
- Traditional/PIPS/PIRMS Comparison - Questions identifying the difference between the two systems in terms of cost, time, and quality. Seven questions were asked and the practitioner would have to give two (1-10) ratings for each question, one to the PIPS/PIRMS model and one to the Traditional models.

Both surveys asked the same statements, but in the 2012 survey the statements were changed slightly. This was an attempt to simplify the statements, trying to ensure each question and statement was one dimensional, so the answer was based on only one factor. Figures 12 and 13 show the difference between the PIPS/PIRMS factors section for the 2011 and 2012 surveys.

#	PIPS Factors/Characteristics	PIPS Factor is Different From Traditional Systems	PIPS Factor Decreases the Time it Takes to Deliver the Service	PIPS Factor Decreases the Cost of the Service	PIPS Factor Increases the Quality of the Service
		(1-10)	10=Agree, 5=Don't know, 1=Disagree		
1	System is based on a no-influence, no-control, no management philosophy				
2	Contract is used to mitigate risk instead of being a legal/regulatory/control document.				
3	The supplier creates the contract				
4	System focuses on project pre-planning instead of project implementation				
5	System does not require the buyer to identify the scope of the project.				
6	System tries to minimize buyer/supplier communication/transactions				
7	System assumes vendor has no technical risk and focuses on mitigating risk the vendor does not control				
8	System uses dominant information and minimizes decision making of buyer and supplier				

Figure 12: 2011 Survey Part 1

#	PIPS/PIRMS Factors	Factor is Different From Traditional Systems	Factor contributes to the success (\$\$, Time, Quality) of a project
		(1-10) 10=Agree, 5=Don't know, 1=Disagree	
1	System is based on a no-control philosophy		
2	Contract is used to mitigate risk instead of being a regulatory control document.		
3	The supplier creates the contract		
4	System focuses on project pre-planning instead of project implementation		
5	System does not require the buyer to identify the scope of the project.		
6	System tries to minimize buyer/supplier communication		
7	System focuses on mitigating risk the vendor does not control		
8	System minimizes decision making of buyer and supplier through the use of dominant information		

Figure 13: 2012 Survey Part 1

The following were the main changes to the survey from 2011-2012:

- Due to the complexity of the matrix being filled out in 2011 (4 columns), the survey was adjusted in 2012 to only have two columns. Thus, only two statements were asked in 2012. One column stating the factor was different from traditional systems and the other stating the factor contributes to the value of a project (Figures 12 and 13).
- Questions where the answer could be prompted by two factors were changed to making sure the answer could only be prompted by one factor (Table 6, changes highlighted).
- PIPS was changed to PIPS/PIRMS – Although in academic literature PIPS is split out from PIPS/PIRMS, this distinction has not taken root in the industry. Thus, in 2011, PIPS was used to denote PIPS/PIRMS as well. In 2012, PIPS/PIRMS was beginning to be acknowledged by the industry as the management portion of PIPS, so the survey was changed to PIPS/PIRMS, to adjust to the industries knowledge. This was not to change the meaning of the measurement.

In Table 6 and 7 it shows the changes made to the wording of each survey for both parts of the survey. The main changes you see are eliminations in wording. This was in all cases an attempt to make the question one dimensional. Trying to ensure that the answer for each question can only have one meaning. The descriptive words were cut down in the 2012 survey, trying to make the questions as clear as possible.

In Table 6, the factor each characteristic wording represents is shown. It also shows the number for the characteristic(s) the survey wording was taken from (see Literature Research Information).

Characteristic #	2011 Survey PIPS/PIRMS Characteristics	2012 Survey PIPS/PIRMS Characteristics	Factor
18 and 2	System is based on a no-influence , no-control, no management philosophy	System is based on a no-control philosophy	No-influence, no-control, no management philosophy
49	Contract is used to mitigate risk instead of being a legal/regulatory/control document.	Contract is used to mitigate risk instead of being a regulatory control document.	Seamless Contract
53	The supplier creates the contract	The supplier creates the contract	Supplier creates the contract
21	System focuses on project pre-planning instead of project implementation	System focuses on project pre-planning instead of project implementation	Pre-planning
50	System does not require the buyer to identify the scope of the project.	System does not require the buyer to identify the scope of the project.	Problem Contracting
43	System tries to minimize buyer/supplier communication/ transactions	System tries to minimize buyer/supplier communication	Communication Minimization
35	System assumes vendor has no technical risk and focuses on mitigating risk the vendor does not control	System focuses on mitigating risk the vendor does not control	Expert Supplier Model
7	System uses dominant information and minimizes decision making of buyer and supplier	System minimizes decision making of buyer and supplier through the use of dominant information	Dominant Information

2011 PIPS/PIRMS Model vs. Traditional Systems Statements	2012 PIPS/PIRMS Model v s. Traditional Systems Statements
System is able to identify the best value for the client (low price for highest value)	-
System increases efficiency of the project (terms of time, cost, quality)	System increases efficiency of the project (terms of time, cost, quality)
Very satisfied with the performance of the system	Satisfied with the performance of the system
System requires less resources and effort from both clients and vendors	System requires less resources
System brings higher performing and higher trained vendors and personnel	System brings higher performing suppliers
System is fair, transparent, and open.	System is transparent
	System is fair
Personal Understanding of the System	Personal Understanding of the System

The surveys were given at registration of the 2011 and 2012 Annual Best Value Conferences. This was done to ensure that the practitioners' opinions were not skewed by the one week training of the conference. Upon registering at the front desk the practitioner was handed the survey and asked to complete it before being able to register. The administration would give brief instructions to the practitioner and would be available to the practitioners if they had any questions concerning the survey.

The only difference in the administration of the survey from 2011 to 2012 is that during the latter it was emphasized to the practitioners that if they did not know the answer or understand what the question was asking, they were to rate the question a 5 (identifying that they did not know).

The survey was then collected from the practitioner when they registered. There was no time limit for the survey. Thus, the practitioner could spend as much time thinking about each question as they thought necessary. After all the surveys were collected, the data was inputted into an excel spread sheet. The data was then reviewed to identify the validity of each survey. A survey was disqualified (not used in the research) for one of two reasons:

- The practitioner did not have any knowledge of the PIPS/PIRMS process (The only score they inputted into the survey was a 5 and they had 1 year of experience or less)
- The practitioner did not complete at least half of the survey.

The rest of the surveys were then used for the analysis found in this research. Table 8 shows the comparison of the two conferences survey participants. There were 28% more surveys disqualified in 2011 than in 2012. The reason the number disqualified in 2011 is so much larger than in 2012 is due to the complexity of the survey in 2011. The amount disqualified in 2011 is one of the main reasons the survey was changed in 2012 (as explained in the previous section).

Table 8: Summary Table for 2011 and 2012		
Characteristic	2011	2012
Total # of Surveys:	241	171
# Disqualified:	93	17
% Disqualified:	38%	10%
# of Suppliers:	96	93
# of Buyers:	46	61
Average yrs. experience with PIPS/PIRMS:	2.2	1.5
# of different U.S. State represented:	28	22
# of Countries represented	4	4
# of Different Organizations represented	116	84

The data for the 2011 and 2012 surveys can be found in the Survey Data excel file posted at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

Due to the number and quality of practitioners, the surveys provide indication for justification of the factors. We conducted statistics to illustrate the justification in this chapter. The number is not large enough to have statistical proof. We come back on this point in Chapter 7. Further evidence is created through the case study in Chapter 5.

The basic statistics (i.e. mean, standard deviations, etc.) for the surveys were performed in excel. T-tests and other charts were performed by using SPSS software and excel.

4.3 2011 Exploratory Survey Results

This section reviews the results of the industry survey conducted at the 2011 Best Value Conference in Tempe, Arizona. The survey was successfully completed by 148 practitioners.

The result of the survey found the following:

- 83% of the scores showed that the practitioners believed that the 8 unique PIPS/PIRMS factors identified by the literature search are different from other (traditional) buyer/supplier systems.
- 62% of the scores showed that the practitioners believed that the factors decrease the amount of time it takes to deliver a project.
- 58% of the scores showed that practitioners believe the 8 factors lower the cost of a project.
- 71% of the scores showed that practitioners believe that the factors increase the quality of the service provided.
- On average the practitioners feel that PIPS/PIRMS buyer/supplier system out performs the traditional system in the areas identified in the survey (efficiency, performance, transparency, fairness, and identifying higher performing suppliers) by a factor of 4.25 points on a 10 point scale. This means the practitioners rated the PIPS/PIRMS system on average a 8.12 (out of 10) and the traditional system a 3.87 (out of 10) (average of questions 1-6 for the second part of the survey) (see Table 14).

On average 29% of the practitioners were not certain of the impact of the PIPS/PIRMS factors and identified that they did not have enough information to know what the impact of the characteristic was (rating of 5). It was also found that a small percentage (on average 7%) of practitioners actually disagreed with the findings of the survey that the PIPS/PIRMS:

1. 8 Factors identified are unique.
2. The unique factors decrease the time it takes to deliver a project.
3. The unique factors lower the cost of a project.
4. The unique factors increase the quality of a project.

Surveyed participants had a tough time answering the 5th statement in the PIPS/PIRMS factor section, which stated that, “Problem Contracting”. This question had the largest quantity of 5 ratings indicating they did not have enough information to know the answer (19%). The rating from all the different practitioners concerning this characteristic also had a standard deviation of over 3.53, on a 10 point scale, which is on average 1.18 points above any of the other statements. This may signify an area in the PIPS/PIRMS process that many users of PIPS/PIRMS have trouble with. However, despite the number of "5" ratings received on this question, still 61% of the practitioners agreed that the characteristic was unique.

In conclusion, it was found that there is strong evidence to believe that the industry practitioners are in agreement with the literature search and furthermore that they also believe the factors improve customer satisfaction and value (cost, time, and quality) of a project for the better.

4.3.1 Details of 2011 Survey Analysis

The analysis was divided into two sections:

- PIPS/PIRMS factors
- PIPS/PIRMS system vs. Traditional Systems

PIPS/PIRMS Factor Section

In 2011, this section identified the eight PIPS/PIRMS factors and the practitioner were given four statements concerning each factor:

- PIPS/PIRMS factor is different from traditional system.
- PIPS/PIRMS factor decreases the time it takes to deliver the project.
- PIPS/PIRMS factor decreases the cost of the project.
- PIPS/PIRMS factor increases the quality of the project.

They were then asked to identify if they agreed (rating of 6-10), disagreed (rating of 1-4), or they did not have enough information to know (don't know) (rating of 5), for each of the four statements concerning each PIPS/PIRMS factor. The difference between higher and lower ratings is the degree to which they agree or disagree with the statement. Meaning a 10 rating identifies they agree with the statement more than a 6 rating and a 1 rating means they disagree with the statement more than a 4 rating. Table 9 below shows how these four statements were given concerning each PIPS/PIRMS factor. It was discovered as practitioners took this portion of the survey, that either the format of the section or the amount of questions asked confused the practitioners. Practitioners had problems filling this section out. This is identified by the number of survey's that were disqualified from the study.

Table 9: Section I Statements Differences in PIPS/PIRMS Compared to Traditional Buyer/Supplier Systems 2011					
#	PIPS/PIRMS Factors	PIPS/PIRMS Factor is Different From Traditional Systems	PIPS/PIRMS Factor Decreases the Time it Takes to Deliver the Project	PIPS/PIRMS Factor Decreases the Cost of the Project	PIPS/PIRMS Factor Increases the Quality of the Project
		(1-10) 6-10=Agree, *5=Don't know, 1-4=Disagree			
1	No-influence, no-control, no management philosophy				
2	Seamless Contract				
3	Supplier Contract Creation				
4	Pre-planning				
5	Problem Contracting				
6	Communication Minimization				
7	Expert Supplier Model				
8	Dominant Information				
*Don't know = do not have enough information to know.					

To analyze the results of this section the ratings were split up into three different categories:

- Agree = Greater than or equal to a 6 rating.
- Don't know or Do not have enough information = 5 rating
- Disagree = less than or equal to a 4 rating

The main statistics (mean, standard deviation, range, etc.) were calculated for each factor and statement, the results will be shown in Tables 10 and 11. This section will now review each of the four statements.

First Statement: PIPS/PIRMS Factor is Different from Traditional System

The analysis reports that the overall mean rating for this section was 8.61 (see Table 11). The full results for each factor (statement) can be found in Table 10 and 11. The results identify that the practitioners agree that the PIPS/PIRMS factors are different from traditional systems. The lowest factor's mean rating was Statement 5 (“Problem Contracting”, Table 9), which reported a mean average of 6.86 (see Table 11). The statement also had the highest population of practitioners that did not know (19%), 8% above the average. (See Table 10 and 11 for the Analysis Breakdown)

- Average % that agreed - 83%
- Average % that didn't know- 11%

- Average % that disagreed - 6%

Second Statement: PIPS/PIRMS Factors Decrease the Time it Takes to Deliver the Project

The analysis reports that the overall mean rating for this section was 7.32 (see Table 11). The results identify that industry participants feel that the PIPS/PIRMS process decreases the time it takes to deliver a service. The highest sub-statement mean rating was Factor 8 (“Dominant Information”), which reported a mean average of 8.06, while the other 7 statements kept mean ratings from 6.00-7.60. This shows that the practitioners see how simplifying information and minimizing decision making minimizes the time it takes to deliver a service. On average 10% disagreed with this statement for the PIPS/PIRMS factors, 28% of practitioners just did not know if the PIPS/PIRMS factors were related to decreasing the time to deliver a service. (See Table 10 and 11 for the Analysis Breakdown)

- Average % that agreed - 62%
- Average % that didn't know - 28%
- Average % that disagreed - 10%

Third Statement: PIPS/PIRMS Factor Decrease the Cost of the Project

The analysis reports that the overall mean rating for this section was 7.12 (see Table 11). The results state that industry participants feel that PIPS/PIRMS process decreases the cost it takes to deliver a service. However, it is the lowest overall mean average rating from the other 3 statement sets. (See Table 10 and 11 for the Analysis Breakdown)

- Average % that agreed- 58%
- Average % that didn't know - 33%
- Average % that disagree- 9%

Fourth Statement: PIPS/PIRMS Factor Increase the Quality of the Project

The analysis reports that the overall mean rating for this section was 7.96 (see Table 11). The results state that industry participants feel that PIPS/PIRMS process increases the quality of a delivered service. 71% of the practitioners felt that PIPS/PIRMS increases the quality of an outsourced project. With a low of 4% who disagree and 25% who do not have enough information to make a decision. (See Table 10 and 11 for the Analysis Breakdown)

- Average % that agreed- 71%
- Average % that didn't know - 25%
- Average % that disagree - 4%

The reviews for each statement were developed from Tables 10 and 11.

Table 10 shows the four statements in this first section and the eight PIPS/PIRMS factors for each statement. It then shows the breakout of how the practitioners rated each factor in

each statement. This table shows the percentage of practitioners that rated in agreement (rating of 6-10), disagreement (rating of 1-4) and those who don't know (rating of 5).

Table 11 shows the four statements and the eight factors again, with the mean, standard deviation and range, of each factor's rating in each statement. This table revealed:

- All factors for each statement had a range of 9 (out of a 1-10 rating), meaning every factor received the highest and lowest ratings for each statement.
- The average standard deviation for each factor in every statement was 2.66.

These two trends show there was variation in the ratings given to each factor for each statement. Due to mean rating being above a 7 for each factor and statement it indicates that 76% of all ratings were either a 10 or a 5 (52% of ratings were a 10 and 24% of ratings were a 5). This also is shown in the Table 10, as on average only 7% of practitioners disagreed (rating 1-4) with any of the statements.

Table 10: Section I Results: Analysis Breakdown 2011									
Statement 1: PIPS/PIRMS Factor is Different From Traditional Systems									
<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg.</u>
Agree (6-10)	95%	91%	76%	85%	61%	80%	84%	92%	83%
*Don't Know (5)	5%	7%	16%	11%	19%	14%	9%	7%	11%
Disagree (1-4)	1%	2%	9%	4%	20%	6%	6%	1%	6%
Statement 2: PIPS/PIRMS Factor Decreases the Time it Takes to Deliver the Service									
<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg.</u>
Agree (6-10)	62%	61%	56%	68%	49%	67%	62%	74%	62%
*Don't Know (5)	31%	30%	33%	21%	34%	26%	28%	21%	28%
Disagree (1-4)	7%	9%	11%	11%	17%	7%	10%	5%	10%
Statement 3: PIPS/PIRMS Factor Decreases the Cost it Takes to Deliver the Service									
<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg.</u>
Agree (6-10)	55%	58%	49%	62%	44%	65%	59%	68%	58%
*Don't Know (5)	33%	33%	40%	30%	43%	29%	33%	26%	33%
Disagree (1-4)	12%	9%	11%	8%	13%	5%	8%	6%	9%
Statement 4: PIPS/PIRMS Factor Increases the Quality of the Service									
<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg.</u>
Agree (6-10)	80%	76%	61%	76%	51%	74%	69%	77%	71%
*Don't Know (5)	18%	21%	32%	20%	40%	23%	26%	22%	25%
Disagree (1-4)	2%	3%	7%	4%	9%	3%	5%	1%	4%
*Don't know = do not have enough information to know.									

**Table 11: Section I Results: Differences in PIPS/PIRMS
Compared to Traditional Buyer/Supplier Systems 2011**

Statement 1: PIPS/PIRMS Factor is Different From Traditional Systems									
<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg.</u>
Mean of the scores	9.42	9.18	8.20	8.87	6.86	8.41	8.61	9.30	8.61
Standard Deviation	1.49	1.78	2.91	2.25	3.53	2.59	2.56	1.64	2.34
Range	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
# of Practitioners	148	148	148	148	148	148	148	148	148
Statement 2: PIPS/PIRMS Factor Decreases the Time it Takes to Deliver the Project									
<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg.</u>
Mean of the scores	7.38	7.20	6.94	7.61	6.35	7.60	7.41	8.06	7.32
Standard Deviation	2.83	2.82	3.04	3.00	3.14	2.76	2.94	2.68	2.90
Range	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
# of Practitioners	148	148	148	148	148	148	148	148	148
Statement 3: PIPS/PIRMS Factor Decreases the Cost it Takes to Deliver the Project									
<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg.</u>
Mean of the scores	6.84	7.10	6.64	7.37	6.28	7.64	7.30	7.78	7.12
Standard Deviation	3.08	2.84	2.96	2.86	2.93	2.64	2.88	2.71	2.86
Range	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
# of Practitioners	148	148	148	148	148	148	148	148	148
Statement 4: PIPS/PIRMS Factor Increases the Quality of the Project									
<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg.</u>
Mean of the scores	8.48	8.28	7.43	8.25	6.78	8.11	7.89	8.43	7.96
Standard Deviation	2.20	2.34	2.89	2.47	2.92	2.47	2.64	2.20	2.52
Range	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
# of Practitioners	148	148	148	148	148	148	148	148	148

Section II-PIPS/PIRMS System vs. Traditional Systems

The second section of the survey was composed of seven statements in which the practitioner was expected to rate their opinion of the statement in regards to:

- PIPS/PIRMS system
- Traditional system

The rating of each statement was the same as the first section, a scale from 1-10, 1-4 meaning disagreement, 5 meaning they don't know or they do not have enough information, and 6-10 meaning in complete agreement. An example of how this was performed is shown in Table 12.

Table 12: Section II Statements: PIPS/PIRMS Process Compared to Traditional Methods				
#	STATEMENT	UNIT	PIPS/PIRMS	Traditional
1	System is able to identify the best value for the client (low price for highest value)	(1-10)		
2	System increases efficiency of the project (terms of time, cost, quality)	(1-10)		
3	Very satisfied with the performance of the system	(1-10)		
4	System requires less resources and effort from both clients and vendors	(1-10)		
5	System brings higher performing and higher trained vendors and personnel	(1-10)		
6	System is fair, transparent, and open.	(1-10)		
7	Personal Understanding of the System	(1-10)		

(Ratings remained the same as first section, 1-10 (6-10 = Agreement, 5=Don't know or not enough information to know, 1-4=Disagreement))

Section II Results

A summary of the results can be found on Tables 13 and 14. Juxtaposing the percentages of the PIPS/PIRMS process results with the Traditional process results we can see that industry practitioners felt that the PIPS/PIRMS process would provide greater satisfaction and value (cost, time, quality). The Traditional process was 50% more likely than the PIPS/PIRMS process to have participants who “Disagreed” or “Did not know” if the process could provide efficient and optimal services. The PIPS/PIRMS process had 90% of practitioners who felt it could provide the supplier with the lowest cost and the highest value, while the Traditional process had 22%.

The survey results found the following when asking practitioners to compare the PIPS/PIRMS with traditional processes:

- 68% of the practitioners feel PIPS/PIRMS will bring the lowest price for the highest value than a traditional buyer/supplier process.
- 65% of the practitioners feel PIPS/PIRMS will increase efficiency of services (time, cost & quality) than a traditional buyer/supplier process.
- 52% of the practitioners are very satisfied with the PIPS/PIRMS system than with traditional systems.
- 45% of the practitioners feel PIPS/PIRMS require less resources/effort than traditional buyer/supplier processes. It is important to note that both processes are equally difficult to understand.
- 66% of the practitioners feel PIPS/PIRMS bring higher performing vendors than the traditional systems.

- 49% of the practitioners feel PIPS/PIRMS is fair and transparent than traditional buyer/supplier processes.

6% “Disagreed” that they were fully satisfied with the performance of the PIPS/PIRMS system, while 41% were in disagreement that the traditional systems met satisfactory performance expectations.

Tables 13 and 14 are laid out similarly to the first section of the survey. Table 13 shows the seven statements and the distribution of ratings of the practitioners for each of the statements, in terms of agreed, don't know, and disagreed. It shows the distribution of the ratings for both the PIPS/PIRMS and the traditional buyer/supplier systems. The difference between the ratings given to the PIPS/PIRMS model and the traditional systems were large enough, the difference could be seen without any further analysis.

Table 14 shows the seven statements and the statistics of mean, standard deviation, and range, for each statement. It shows the statistics for both the PIPS/PIRMS and Traditional process. A couple of observations from the data:

1. The standard deviation is above 2 points for both systems, however, it is .19 higher for the traditional systems. This means the traditional systems had more variability in its ratings than the PIPS/PIRMS.
2. The range of the scores was a 9, meaning that all potential scores were given.

Table 13: Section II Results: Analysis Breakdown 2011								
PIPS/PIRMS								
<u>Statements</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>Overall Avg.</u>
Agree (6-10)	90%	85%	68%	61%	82%	82%	61%	76%
*Don't Know (5)	9%	12%	28%	26%	16%	14%	25%	18%
Disagree (1-4)	1%	3%	4%	13%	2%	4%	14%	6%
Traditional								
<u>Statements</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>Overall Avg.</u>
Agree (6-10)	22%	20%	16%	16%	17%	34%	57%	26%
*Don't Know (5)	31%	36%	43%	39%	31%	23%	31%	33%
Disagree (1-4)	47%	44%	41%	45%	52%	43%	12%	41%

**Don't know = Do not have enough information to know.*

Table 14: Section II Results: Mean and Standard Deviation for Section II 2011

PIPS/PIRMS								
<u>Statements</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>Overall Avg</u>
Mean of the scores	8.80	8.36	7.64	7.11	8.44	8.38	6.93	7.95
Standard Deviation	1.77	2.20	2.44	2.93	2.15	2.28	2.82	2.37
Range	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
# of Practitioners	148	148	148	148	148	148	148	148
Traditional								
<u>Statements</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>Overall Avg</u>
Mean of the scores	3.79	3.85	3.97	3.73	3.49	4.40	6.76	4.28
Standard Deviation	2.44	2.46	2.25	2.38	2.37	3.05	2.96	2.56
Range	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
# of Practitioners	148	148	148	148	148	148	148	148

4.3.2 2011 Exploratory Survey Conclusion

The 2011 survey conducted identified that industry practitioners in general feel that:

- The identified PIPS/PIRMS factors are different than what is found in Traditional systems.
- The PIPS/PIRMS factors improve the customer satisfaction and value of projects (cost, time, quality) (see Table 13).

4.4 2012 Exploratory Survey Results

This section reviews the results of the industry survey conducted at the 2012 Best Value Conference in Tempe, Arizona. The survey was completed by 154 practitioners.

The survey data identified the following:

- 71% agreed that the PIPS/PIRMS factors were different than Traditional buyer/supplier system factors (see Table 16).
- 66% agreed that the PIPS/PIRMS factors contribute to the success or increased value (cost, time, quality) of a project (see Table 16).
- 10% disagreed that the PIPS/PIRMS factors were different and contributed to the success of a project (see Table 16).
- On a 1-10 rating scale the average score for PIPS/PIRMS process was 4.09 points above the other systems in areas of customer satisfaction, efficiency, performance, and higher quality service providers (see Table 22, Average of Statements 1-5) .

In conclusion, it was found that the industry survey validated that the practitioners are in agreement with the results of the literature search. The practitioners believed that the

eight factors were indeed unique to the PIPS/PIRMS system and in general had a positive impact on the cost, time, and quality of services that have used it.

4.4.1 Details of 2012 Survey Analysis

The 2012 survey analysis was similar to the 2011 survey analysis. The analysis was divided into two sections:

- PIPS/PIRMS factors
- PIPS/PIRMS system vs. Traditional Systems

PIPS/PIRMS Factors Section

In 2012, this section was simplified to minimize confusion when the practitioners would take the survey. The modified wording for the PIPS/PIRMS factors was given and the practitioners were given two statements concerning each factor:

- PIPS/PIRMS factor is different from traditional systems.
- PIPS/PIRMS factor contributes to the success or increasing the value of a project (cost, time, quality, satisfaction).

Practitioners were then asked to identify if they agreed (rating of 6-10), disagreed (ratings from 1-4), or did not know (rating of 5), for each of the statements concerning each PIPS/PIRMS characteristic.

Table 15 below shows how the two statements were given for each PIPS/PIRMS factor. The practitioners had less problems and confusion in taking this section of the survey in 2012 than in 2011. This can be seen in the amount of surveys that were disqualified (10%) compared to the 2011 survey (38%).

Table 15: Differences in PIPS/PIRMS Compared to Traditional Buyer/Supplier Systems			
#	PIPS/PIRMS Factors	Factor is Different From Traditional Systems	Factor contributes to the success (\$\$, Time, Quality) of a project
		(1-10) 6-10=Agree, *5=Don't know, 1-4=Disagree	
1	No-influence, no-control, no management philosophy		
2	Seamless Contract		
3	Supplier Contract Creation		
4	Pre-planning		
5	Problem Contracting		
6	Communication Minimization		
7	Expert Supplier Model		
8	Dominant Information		
*Don't know = do not have enough information to know.			

The two different statements will be reviewed now.

First Statement PIPS/PIRMS Factor is Different from Traditional System

The analysis reports that the overall mean rating for this section was 7.79. The results show that participants agree that the PIPS/PIRMS factors are different from Traditional processes. The lowest sub-statement mean rating was Statement 5 (“Problem Contracting”). (See Table 16 and 17 for the Analysis Breakdown)

- Average % that agreed - 71%
- Average % that did not know - 18%
- Average % that disagreed - 11%

Table 16: Section I Results: Differences in PIPS/PIRMS Compared to Traditional Buyer/Supplier Systems 2012									
Statement 1: PIPS/PIRMS Factor is Different From Traditional Systems									
<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg.</u>
Agree (6-10)	69%	81%	73%	81%	51%	59%	77%	77%	71%
Don't Know (5)	19%	15%	16%	15%	21%	18%	18%	18%	18%
Disagree (1-4)	12%	5%	11%	4%	27%	23%	5%	5%	11%
Statement 2: PIPS/PIRMS Factor contributes to success or increasing the value (\$\$, Time, Quality) of a Project									
<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg.</u>
Agree (6-10)	68%	75%	65%	75%	47%	54%	72%	72%	66%
Don't Know (5)	25%	19%	27%	23%	37%	29%	21%	23%	26%
Disagree (1-4)	7%	6%	8%	2%	16%	17%	6%	5%	8%

Table 17 shows the mean rating, standard deviation, range and number of observations from the data for both statements 1 and 2. Some details on the results:

- All the factors had a range of 9, which means both the high and low ends of the rating scale were used by the practitioners for all the questions.
- The standard deviation was on average 2.85 for the factors. This is due to the mean for most of the factors being so high (rating of 8).
- Factors 5 and 6 received the lowest ratings, and we see the standard deviation on their data were the highest out of all the factors (3.52 and 3.54).

Table 17: Section I Results: Mean and Standard Deviation for Section 1 2012

Statement 1: PIPS/PIRMS Factor is Different from Traditional Systems

<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg</u>
Mean of the scores	7.81	8.47	7.94	8.53	6.18	6.79	8.31	8.34	7.79
Standard Deviation	3.06	2.37	3.02	2.29	3.52	3.54	2.51	2.49	2.85
Range	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
# of Practitioners	154.00	154.00	154.00	154.00	154.00	154.00	154.00	154.00	154.00

Statement 2: PIPS/PIRMS Factor Contributes to Success or increasing the value (Cost, Time, Quality) of a Project

<u>PIPS/PIRMS Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>Overall Avg</u>
Mean of the scores	7.79	8.10	7.63	8.34	6.47	6.81	8.12	8.03	7.66
Standard Deviation	2.75	2.63	2.79	2.34	3.01	3.23	2.57	2.56	2.73
Range	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
# of Practitioners	154.00	154.00	154.00	154.00	154.00	154.00	154.00	154.00	154.00

When a scatter plot was created on the data for statement 1 the following was discovered (see Figure 14):

- All of the practitioners with 5 years or more years of experience agreed that all the PIPS/PIRMS factors were unique.
- The practitioners with more experience have less variation in their responses of the PIPS/PIRMS factors uniqueness, their responses moving towards the affirmative.
- Few practitioners rated the factors less than a 5 or in other words disagreed with the statement that the factors were unique from traditional systems.

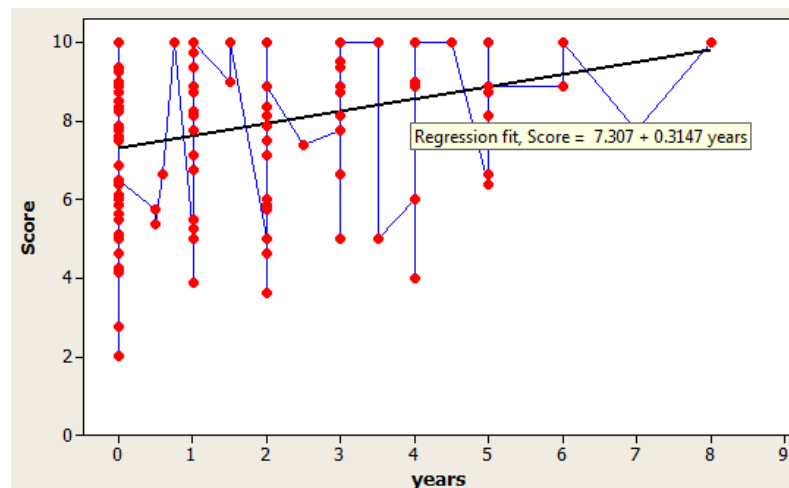


Figure 14: Plot of Mean of the Scores Versus the Years of Experience

The scatter plot suggested that practitioners with less experience would have ratings that were lower than those with higher experience. A T-test was performed to identify if there was a significant difference between practitioners with less than 1.5 years of experience

and practitioners with more than 1.5 years of experience. 1.5 years of experience was identified because it created equal populations to test.

Table 18: Two-Sample T-Test and CI: More than 1.5, less than 1.5				
	N	Mean	StDev	SE
More than 1.5	74	8.52	1.77	0.21
less than 1.5	74	7.01	1.75	0.20
Difference = mu (More than 1.5) - mu (less than 1.5)				
Estimate for difference: 1.515				
95% lower bound for difference: 1.037				
T-Test of difference = 0 (vs.>): T-Value = 5.24				
P-Value = 0.000				
DF = 145				

Table 18 shows the two-sample T-test for more than 1.5 years versus less than 1.5 years. Total numbers of responses are 74 for each. The reason all 154 surveys were not used was due to some of the practitioners not indicating how many years of experience they had. The hypothesis considered is whether the response for practitioners with more than 1.5 years of experience is greater than the response for practitioners with less than 1.5 years of experience. The analysis shows a T value of 5.24, which validates that the hypothesis is significant and the average response of practitioners with more than 1.5 years of experience is greater in value than the score for practitioners with less than 1.5 years of experience for all the statements. Hence the more experience with the PIPS/PIRMS factors a practitioner has the more likely they will identify the 8 PIPS/PIRMS factors as unique.

Second statement: Does the unique PIPS/PIRMS factors contribute to the success or increased value (cost, time, quality) of a project?

The analysis reports that the overall mean rating for this section was 7.66 (see Table 17). The results state that industry practitioners feel that the PIPS/PIRMS factors decrease the time, cost, and increase the quality, of a project. The highest sub-statement mean rating was Statement 4 (“Pre-planning”) (see Table 15) which reported a mean average of 8.34, while the other 7 statements kept mean ratings from 6.47-8.12. We also see that 26% of participants “Don’t Know”. (See Tables 16 and 17 for the analysis Breakdown) Some general remarks on Table 16:

- Average % that agreed - 66%
- Average % that did not know due to not having enough information - 26%
- Average % that disagreed - 8%

Figure 15 shows the variation in the scores with the number of years of experience. The chart identifies that the more experience a practitioner has with PIPS/PIRMS, the more likely he/she will agree that the factors impact, cost, time, and quality of a project for the better.

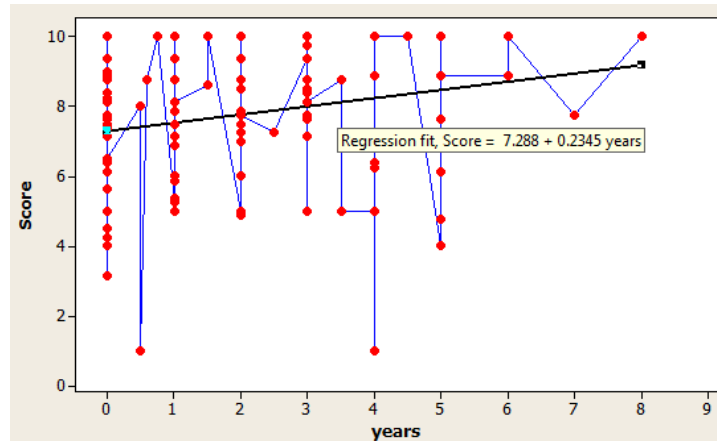


Figure 15: Plot of Score Versus the Years of Experience

A T-test, was also performed for Statement 2, looking at the correlation between the experience of the practitioner and their rating of the statement. In this analysis the mean scores of the ratings provided by the practitioners for the second subsection are divided in two equal pools. The first pool is the number of practitioners with the experience of more than 1.5 years and the second one is less than 1.5 years.

Table 19: Two-sample T-test for more than 1.5 years vs. less than 1.5 years				
	N	Mean	StDev	SE Mean
more than 1.5 years	74	8.27	1.91	0.22
less than 1.5 years	74	7.01	1.99	0.23
Difference = mu (more than 1.5 years) - mu (less than 1.5 years)				
Estimate for difference: 1.267				
95% lower bound for difference: 0.736				
T-Test of difference = 0 (vs.>): T-Value = 3.95				
P-Value = 0.000				
DF = 145				

The analysis shows the two-sample T-test for more than 1.5 years versus less than 1.5 years (see Table 19). Total numbers of responses are 74 for each. The reason all 154 surveys were not used was due to some practitioners not indicating how many years of experience they had. The hypothesis considered here is whether the response for practitioners with more than 1.5 years of experience is greater than the response for less than 1.5 years. The T value is 3.95, thus, it can be concluded that the hypothesis is significant and the average response for practitioners with more than 1.5 years of experience is greater in value than the score for practitioners with less than 1.5 years for all the questions. Hence, the more experience with the PIPS/PIRMS factors a practitioner has the more likely he will believe that the 8 PIPS/PIRMS factors have a greater impact on the, cost, time, and quality of a project for the better.

Section II –PIPS/PIRMS System vs. Traditional Systems

In 2012, this section was also adjusted to try and ensure that the rating for each statement was due to only one reason. Table 20 shows the survey that was used. The practitioner

was to identify their agreement to each statement in regards to the PIPS/PIRMS and traditional systems.

Table 20: Results of PIPS/PIRMS Process Compared to Traditional Methods				
Rate each of the statements on a scale of 1 to 10, with 6-10 representing complete agreement and 1-4 representing complete disagreement with the statement. 5 representing you don't have enough information to know				
NO	STATEMENTS	UNIT	PIPS/PI RMS	Traditional
1	System increases efficiency of the project (terms of time, cost, quality)	(1-10)		
2	Satisfied with the performance of the system	(1-10)		
3	System requires less resources	(1-10)		
4	System brings higher performing suppliers	(1-10)		
5	System is fair	(1-10)		
6	System is transparent	(1-10)		
7	Personal Understanding of the System	(1-10)		

Juxtaposing the percentages of the PIPS/PIRMS process results with the traditional process results we can see that industry participants mostly “agreed” that PIPS/PIRMS process would provide better service (Statement 1), greater efficiency, use less resources (Statement 1 and 3), and provide the best cost (Statement 1) (see Tables 21, 22, 23). Traditional processes were 50% more likely than the PIPS/PIRMS process to have participants who “Disagreed” or “Did not know” if the process could provide efficient and optimal services (see Table 21).

On average 75% of the practitioners agreed with the PIPS/PIRMS statements with 2% disagreeing with them. The results also show that almost an equal amount of practitioners rated in agreement with the PIPS/PIRMS process as, didn’t know or disagreed with the traditional system. These numbers indicate that either the practitioners were not satisfied with the traditional systems or they were confused whether it served them good or bad (i.e. had no knowledge of the system).

The results show that Statement 7, (“Personal understanding of the system”) had a “disagree” rating of 6% and a “don’t know” rating of 32%. This could be explained by the fact that the average years of experience with PIPS/PIRMS was 1.5 years.

Table 21: Section II Results: Analysis breakdown 2012								
PIPS/PIRMS								
<u>Statements</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>Overall Avg.</u>
Agree (6-10)	84%	73%	56%	84%	81%	84%	62%	75%
*Don't Know (5)	15%	27%	36%	16%	19%	15%	32%	23%
Disagree (1-4)	1%	1%	8%	0%	0%	1%	6%	2%
Traditional								
<u>Statements</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>Overall Avg.</u>
Agree (6-10)	15%	23%	14%	15%	25%	25%	57%	25%
*Don't Know (5)	44%	47%	47%	40%	40%	39%	29%	41%
Disagree (1-4)	42%	30%	40%	45%	34%	36%	14%	34%

**Don't know = Do not have enough information to know.*

Table 22: Section II Results: Mean and Standard Deviation for Section II 2012								
PIPS/PIRMS								
<u>Statements</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>Overall Avg</u>
Mean of the scores	8.58	7.84	6.95	8.65	8.52	8.69	6.92	8.02
Standard Deviation	1.95	2.10	2.67	1.89	1.98	1.94	2.40	2.13
Range	9.00	7.00	9.00	5.00	5.00	7.00	9.00	7.29
# of Practitioners	154	154	154	154	154	154	154	154
Traditional								
<u>Statements</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>Overall Avg</u>
Mean of the scores	3.80	4.33	3.84	3.60	4.53	4.47	6.70	4.47
Standard Deviation	2.27	2.22	2.32	2.25	2.69	2.80	2.98	2.51
Range	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
# of Practitioners	154	154	154	154	154	154	154	154

Basic T Test Analysis over the Survey

The Basic T Test is performed on the survey responses for PIPS/PIRMS and Traditional for the same set of statements (Table 23).

Table 23: Two-sample T-test for PIPS/PIRMS vs. Traditional				
	N	Mean	StDev	SE Mean
PIPS/PIRMS	154	8.09	2.67	0.10
Traditional	154	4.50	2.65	0.12
Difference = mu (PIPS/PIRMS) - mu (Traditional)				
Estimate for difference: 3.63356				
95% lower bound for difference: 3.512				
T-Test of difference = 0 (vs.>): T-Value = 33.07				
P-Value = 0.000				
DF = 308				

The analysis shows the two-sample T-test for PIPS/PIRMS versus Traditional. Here the comparison of the responses for each statement (10 being the best and 1 being the worst) is done. Total numbers of responses are 154 for each PIPS/PIRMS and Traditional. Next the mean, standard deviation and the mean squares are indicated for each. The hypothesis considered here is whether the response for PIPS/PIRMS is greater than the response for Traditional. T value will decide the significance of the hypothesis. As the T value is 33.07 it can be concluded that the hypothesis is significant and the average response of PIPS/PIRMS is greater in value than traditional for all the statements.

Additional analysis was performed to understand the data. Looking at the data it was difficult to identify the relationship between the ratings and the years of experience. Figure 16 (contour plot) shows the relationship between the level of experience practitioners have with the PIPS/PIRMS process and how they evaluated the performance of the Traditional and PIPS/PIRMS processes. The contour plot shows the PIPS/PIRMS rating on the x-axis and the traditional rating on the y-axis. The color on the contour plot identifying the level of experience with the PIPS/PIRMS process. The darker color identifying more experience. Figure 16 shows the variation in the ratings for PIPS/PIRMS and Traditional for each practitioner over the number of years of experience with PIPS/PIRMS. As it is seen from the contour, below 3 years of experience most of the practitioners have rated all over the range for both PIPS/PIRMS and traditional. A large portion of people from the group of 3 to 4 years of experience have rated both traditional and PIPS/PIRMS above 7. All the groups above 5 years of experience have rated PIPS/PIRMS around 10 and traditional below 4. This indicates that practitioners with an experience of 5 or more years with PIPS/PIRMS system rate it better than the traditional system. We saw the same conclusion with the factors in Section 1 (see Figure 14).

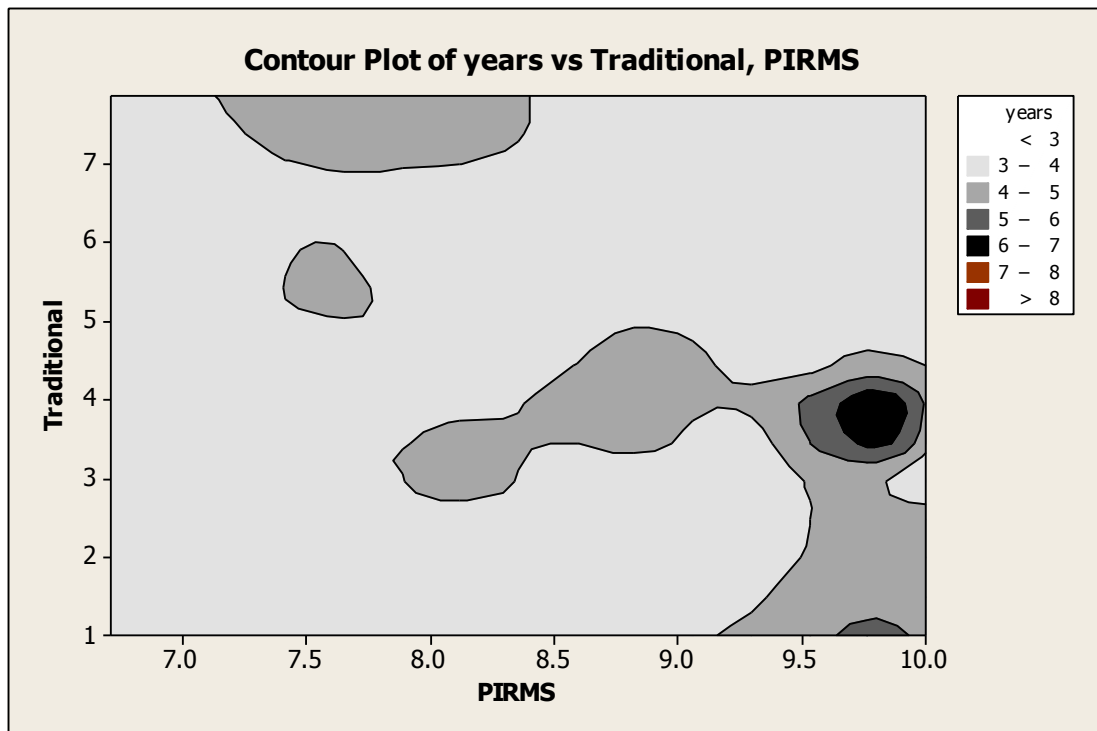


Figure 16: Contour Plot for Scores for PIPS/PIRMS and Traditional Versus the Years of Experience

4.4.2 2012 Survey Conclusion

This section reviewed the results of the survey conducted at the 2012 Best Value Conference in Tempe, Arizona. The survey was completed by 154 practitioners.

The survey data identified the following:

- 71% agreed that the PIPS/PIRMS factors were different than Traditional buyer/supplier system factors (see Table 16).
- 66% agreed that the PIPS/PIRMS factors contribute to the success or increasing the value of a project (see Table 16).
- 11% disagreed that the PIPS/PIRMS factors were different and contributed to the success of a service (see Table 16).
- 8% disagreed that PIPS/PIRMS factors contribute to the success or increasing the value of a project (see Table 16).
- On a 1-10 rating scale the average score for PIPS/PIRMS process was 4.09 points above the other systems in areas of customer satisfaction, efficiency, performance, and higher quality service providers (see Table 22, did not include statement 6 and 7 in average).
- Practitioners that have used the PIPS/PIRMS system longer have a greater belief that the eight factors are different from other buyer/supplier systems and that the factors have a greater impact on the cost, time, and quality of services being provided (Figure 14, Figure 15, Figure 16, Table 19).

In conclusion, it was found that the industry survey validated that the practitioners are in agreement with the literature research. The practitioners believed that the eight factors

were indeed unique to the PIPS/PIRMS system and in general had a positive impact on the customer satisfaction, cost, time, and quality of services that have used it.

4.5 Comparison of Surveys 2011 and 2012

This section compares the results of the 2011 and 2012 exploratory surveys. To compare the results we will split the analysis into the two different sections of the surveys.

We will first look at comparing Section 1 of the survey for 2011 and 2012. Then we will look at how the second section of the survey matchup between 2011 and 2012.

4.5.1 Section I

For Section I the 2012 survey was modified to reduce the number of sub-sections. Three of the subsections on PIPS/PIRMS characteristic affecting cost, time, and quality of the project were combined in to one.

Table 24: Survey Results for 2011 and 2012							
Sub-Sections	Year	Overall Average					Practitioners
		Greater than or equal to 6	Equal to 5	Less than or equal to 4	Mean Score	Standard Deviation	
PIPS/PIRMS Factor is different From traditional systems	2011	83%	11%	6%	8.61	2.34	148
	2012	71%	18%	11%	7.79	2.85	154
PIPS/PIRMS Factor is decreases the time to deliver the project	2011	62%	28%	10%	7.32	2.90	148
PIPS/PIRMS Factor decreases the cost it takes to deliver a project	2011	58%	33%	9%	7.12	2.86	148
PIPS/PIRMS Factor increases Quality of the service	2011	71%	25%	4%	7.96	2.52	148
PIPS/PIRMS Factor contributes to success or value (\$\$, Time ,Quality) of the project	2012	66%	26%	8%	7.66	2.73	154

From the numbers in the Table 24 it can be concluded that both years confirm that the PIPS/PIRMS factors are different with means of 8.61 for the 2011 survey and a mean of 7.79 for the 2012 survey. It is also evident that the percentage of practitioners that agree

with the “PIPS/PIRMS factor is different than the traditional system” has gone down by 12%, however, the practitioners belief that the factor's have contributed to a project's success has increased by 3% (taking average of the three 2011 statements regarding time, cost, and quality, and comparing with the 2012 "success" statement) for the “PIPS/PIRMS contribution in success of the project.” Table 25 shows the difference in the mean ratings for each PIPS/PIRMS factor and statement provided by the practitioners in years 2011 and 2012. In 2011 instead of only 2 statements there were 4 statements. Instead of the second statement “PIPS/PIRMS contributes to success or increased value (cost, time, quality) of the project” there were 3 separate statements for cost, time and quality respectively. In Table 25 the 3 separate statements were averaged together and compared to the 2012 second characteristic “PIPS/PIRMS contributes to success or increased value (cost, time, quality) of the project.” The maximum value of difference between the 2011 and 2012 surveys for the 8 factors is 1.62 with a maximum percentage change of 19%. It seems that in both surveys there was evidence to believe that the PIPS/PIRMS factors are not only different from traditional systems, but they also seem to have an impact on the success of a project or service.

Table 25: 2011 and 2012 Mean Rating Comparison			
		Mean of Scores	
		Year	
Statements	Statement	2011	2012
PIPS/PIRMS Factor is different than Traditional	1	9.42	7.81
	2	9.18	8.47
	3	8.20	7.94
	4	8.87	8.53
	5	6.86	6.18
	6	8.41	6.79
	7	8.61	8.31
	8	9.30	8.34
PIPS/PIRMS Factor contributes to success (Cost, Time ,Quality) of the project	1	7.57	7.79
	2	7.53	8.10
	3	7.00	7.63
	4	7.74	8.34
	5	6.47	6.47
	6	7.79	6.81
	7	7.53	8.12
	8	8.09	8.03

Table 25 shows that there is a difference in the 2011 and 2012 survey. One of the differences between the 2011 and 2012 surveys is the level of experience the practitioners had with PIPS/PIRMS. In 2011 the average practitioner had 2.27 years of experience with PIPS/PIRMS and in 2012 they had 1.57. A T-test was performed to find out the significance. The T-test compared all practitioners with 2 or more years of experience in 2011, with all practitioners with 2 or more years of experience in 2012. Two years was

decided to be the dividing line, because in 2011 with the average being 2.27 years of experience the ratings were higher. The hypothesis was identified that if we took only the practitioners with 2 or more years from each year there should not be a significant difference between their scores. It was found that in 2011 there were 73 surveyors while in 2012 there were 62 surveyors with 2 or more years of experience. This made uneven groups for the T-test. Since the same amount of ratings were needed for both the 2011 and the 2012 surveys, the individual pools were randomly sampled for 55 samples from each group. Then the T-test was performed on the acquired samples. Table 26 shows results for the first part of Section 1 and Table 27 shows results for the second part of Section 1.

Table 26: Two-Sample T-Test and CI:				
Mean of First Part of Section 1 2011, Mean of First Part of Section 1 2012				
	N	Mean	StDev	SE Mean
Mean of section 2011	55	7.85	1.71	0.23
Mean of section 2012	55	8.40	1.59	0.21
Difference = mu (Mean of section 2011) – mu (Mean of section 2012)				
Estimate for difference: -0.549				
95% CI for difference: (-1.175, 0.076)				
T-Test of difference = 0 (vs.not =): T-Value = -1.74				
P-Value = 0.084				
DF = 108				
Both use Pooled StDev = 1.6540				

Table 27: Two-sample T for Second Part of Section 1 of PIPS/PIRMS 2011 Vs. PIPS/PIRMS 2012				
	N	Mean	StDev	SE Mean
PIPS/PIRMS 2011	55	8.37	1.48	0.20
PIPS/PIRMS 2012	55	8.53	1.46	0.20
Difference = mu (PIPS/PIRMS 2011) - mu (PIPS/PIRMS 2012)				
Estimate for difference: -0.161				
95% CI for difference: (-0.716, 0.394)				
T-Test of difference = 0 (vs.not =): T-Value = -0.57				
P-Value = 0.567				
DF = 108				
Both use Pooled StDev = 1.4688				

The results of the T-test for both of the survey parts in Section 1 show that there is no significant difference in the scoring between practitioners with 2 or more years of experience from 2011 to 2012.

To ensure that there was not a major difference between the ratings of the 2011 survey and the 2012 survey, T-tests, were performed on the major sections for all the data, including:

- If the PIPS/PIRMS factors were different from traditional systems.

- If the PIPS/PIRMS factors contributed to the success or increased value of a project.

Table 28 shows the result of each T-test conducted. The results show that in each T-test no major difference could be found between the 2011 and 2012 ratings. Thus, despite the changes that were made to the 2012 survey, the participants still rated each section of the survey the same.

The P-value is the probability of significance for the alternative hypothesis; the smaller the P-value the more significant the difference in the mean values which makes it easier to reject the null hypothesis. In general, if the T-Test is performed for the alternative hypothesis (2011 and 2012 surveys are not equal or one is greater than other) and if we get the P-value > 0.05 (α is the significance level decided by the confidence interval) then it suggests that there is no significant difference between the two means and we would not reject the null hypothesis.

In our case, we consider the null hypothesis as ‘There is no significant difference between the 2011 and 2012 surveys’ and different alternative hypothesis as ‘There is significant difference between the 2011 and 2012 surveys – not equal or one is greater than the other’.

Table 28: Summary Table of the T-Test for Survey 2011 and 2012 Showing No Difference in the Responses			
Characteristic	Alternative Hypothesis for 2011 and 2012 surveys	P-Value	Conclusion
PIPS/PIRMS Factor is different than Traditional	Greater than	0.491	As P-value is greater than 0.05 so the null hypothesis cannot be rejected
	Less than	0.512	
	Not equal to	0.981	
PIPS/PIRMS Factor contributes to the success of the project	Greater than	0.403	As P-value is greater than 0.05 the null hypothesis cannot be rejected
	Less than	0.597	
	Not equal to	0.806	

From the summary table it is evident that none of the alternative hypothesis hold against the null hypothesis. In other words we cannot reject the null hypothesis which also means that the 2011 and 2012 survey responses for practitioners with 2 or more years of experience with PIPS/PIRMS are similar with no difference in their means (confidence of 95%). Therefore, for both sections of the survey for years 2011 and 2012 there is not enough difference in the responses received even though the statements asked had changes in them.

Construction Practitioners vs. Service Practitioners

To identify if construction practitioners felt differently than service practitioners the survey data for both the 2011 and 2012 surveys were divided into the two groups and a two tailed T-test was performed for each year, with a 95% confidence interval, to identify if one group felt differently about the uniqueness of the 8 PIPS/PIRMS factors. The resulting p-value for both the 2011 and 2012 results were as follows:

- 2011 T-test: .129
- 2012 T-test: .795

Since the p-values are both higher than .05, the results show there is no statistical significance. This leads us to conclude that construction and service practitioners rated and feel the same about the uniqueness of the PIPS/PIRMS factors.

4.5.2 Section II

Since there were two different statements asked in 2012 and 2011 for the second section of the survey, the researchers averaged the statements together to make a comparison between the two. Table 29 shows that the 2012 survey showed a decrease in agreement (score 6-10) with the PIPS/PIRMS process performance and effectiveness (1%). The traditional process also saw a decrease from 2011 to 2012 (1%). The change did not occur due to practitioners disagreeing with the PIPS/PIRMS’s performance and effectiveness, it occurred due to more people not knowing what the performance and effectiveness of the process was. This can be seen in Table 29. Looking at the difference between the PIPS/PIRMS ratings for 2011 and 2012, you see that the percent of "5" ratings increases from 18% to 23%. The traditional system saw a decrease in approval (scores 6-10) due to the same reason. In fact, less people disagreed with the traditional system in 2012 and identified they did not know.

Table 29: Overall Averages for 2011 and 2012							
System	Year	Overall Average					Practitioners
		Greater than or equal to 6	Equal to 5	Less than or equal to 4	Mean Score	Standard Deviation	
PIPS/PIRMS	2011	76%	18%	6%	7.95	2.37	148
	2012	75%	23%	2%	8.02	2.13	154
Traditional	2011	26%	33%	41%	4.28	2.56	148
	2012	25%	41%	34%	4.47	2.51	154

**Note: Agree = Greater than or equal to 6; Don’t know = Equal to 5; Disagree = Less than or equal to 4;*

A T-test was performed on the results of 2011 and 2012 to identify if there was a significant difference in the scoring from 2011 to 2012. Two T-test had to be performed since this section asked statements on the performance and efficiency of PIPS/PIRMS and the Traditional process. Thus the T-test were split into the PIPS/PIRMS and Traditional data sets. A two tailed T-test was performed with a 95% confidence interval, randomly

taking 55 surveys from each year as the data. The results are seen below in Table 30 and 31.

Alternative hypothesis were also tested in the same manner, which include (see Table 32):

- 2012 results could be greater than 2011 results
- 2012 results could be less than 2011 results
- 2012 results are not equal to 2011 results

The P-value for the T-test performed on the alternative hypothesis came back more than 0.05 (see Table 32) thus all alternative hypothesis can be rejected. This means that the response of 55 randomly sampled practitioners from 2011 and 2012 is not different.

Table 30: Two-sample T for PIPS/PIRMS 2011 vs. PIPS/PIRMS 2012				
	N	Mean	StDev	SE Mean
PIRMS 2011	55	8.37	1.48	0.20
PIRMS 2012	55	8.53	1.46	0.20
Difference = mu (PRIMS 2011) - mu (PIRMS 2012)				
Estimate for difference: -0.161				
95% CI for difference: (-0.716, 0.394)				
T-Test of difference = 0 (vs. not =): T-Value = -0.57				
P-Value = 0.567				
DF = 108				
Both use Pooled StDev = 1.4688				

Table 31: Two-sample T for Traditional 2011 vs. Traditional 2012				
	N	Mean	StDev	SE Mean
Traditional 2011	55	3.76	1.87	0.25
Traditional 2012	55	3.89	2.26	0.30
Difference = mu (Traditional 2011) - mu (Traditional 2012)				
Estimate for difference: -0.123				
95% CI for difference: (-0.907, 0.660)				
T-Test of difference = 0 (vs. not =): T-Value = -0.31				
P-Value = 0.756				
DF = 108				
Both use Pooled StDev = 2.0729				

Table 32: Summary Table of the T-Test for Survey 2011 and 2012 Showing No Difference in the Responses

Characteristic	Alternative Hypothesis for 2011 and 2012 surveys	P-Value	Conclusion
PIPS/PIRMS	Greater than	0.456	As P-value is greater than 0.05 the null hypothesis cannot be rejected
	Less than	0.544	
	Not equal to	0.912	
Traditional	Greater than	0.579	As P-value is greater than 0.05 the null hypothesis cannot be rejected
	Less than	0.421	
	Not equal to	0.841	

4.6 Conclusion

The results of the 2011 and 2012 surveys and the similarity in their results helps to affirm the literature results that have identified the eight factors in Table 33 as unique to PIPS/PIRMS.

Table 33: PIPS/PIRMS Factors Uniqueness		
PIPS/PIRMS Factor	% of Practitioners that felt PIPS/PIRMS factor was unique (rated 6 or higher) (Avg. of 2011 and 2012 survey)	Average 1-10 rating of each factor
No-influence, no-control, no management philosophy	82%	8.61
Seamless contract	86%	8.82
Supplier contract creation	74%	8.07
Pre-planning	83%	8.70
Problem Contracting	56%	6.52
Communication Minimization	69%	7.6
Expert Supplier Model	81%	8.46
Dominant Information	84%	8.82

These results also answer the second Sub-Research Question (Chapter 2): Is there evidence that practitioners feel PIPS/PIRMS factors are different from other buyer/supplier systems. The results show that practitioners agree, with the literature research results, that the 8 unique PIPS/PIRMS factors identified (Chapter 3) are unique.

The survey results also answered the third Sub-Research Question (Chapter 2): Is there evidence that practitioners feel the unique PIPS/PIRMS factors create increased customer

satisfaction and value on projects. Tables 34 and 35 show the percent of practitioners that feel each unique PIPS/PIRMS factor can improve the value (cost, time, and quality) on projects. The results also found that the practitioners were more satisfied with the PIPS/PIRMS factors than traditional systems. Table 36 shows verification that customer satisfaction is greater when using the PIPS/PIRMS factors than with traditional systems.

Table 34: PIPS/PIRMS Factors Lead to Increased Value		
PIPS/PIRMS Factor	% of Practitioners that felt PIPS/PIRMS factor creates success or value on projects (rated 6 or higher) (Avg. of 2011 and 2012 Survey)	Average 1-10 rating of each factor
No-influence, no-control, no management philosophy	67%	7.68
Seamless contract	70%	7.81
Supplier contract creation	60%	7.32
Pre-planning	72%	8.04
Problem Contracting	48%	6.47
Communication Minimization	61%	7.30
Expert Supplier Model	68%	7.83
Dominant Information	73%	8.06

Table 35: PIPS/PIRMS 2011/2012 Factor Performance	
Survey Part II -Statements 2,3,4,5,6	% of Practitioners Surveyed that Agree with the Statement (Avg. of 2011 and 2012 survey results)
System increases efficiency of the project (terms of cost, time, quality)	79%
Satisfied with the performance of the system	62%
System requires less resources	72%
System brings higher performing suppliers	82%
System is fair	83%
Overall Average	76%

Table 36: Difference in Satisfaction of PIPS/PIRMS Factors and Traditional Systems		
Survey Part II - Statement 3	Average rating of Practitioners for the PIPS/PIRMS factors (Avg. of 2011 and 2012 survey results)	Average rating of Practitioners for Traditional Systems (Avg. of 2011 and 2012 survey results)
Satisfied with the performance of the system	7.29	3.90

Verification of Tables 33,34,35 and 36 can be found in the Survey Data document (Average of 2011 and 2012 Tab) located at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>

The validation of the 8 PIPS/PIRMS factors brings to light a different paradigm for buyer/supplier systems, than what has been documented in academic literature and practiced by industry practitioners. The practitioners agreeing that the factors improve customer satisfaction and value of projects, identifies that this new paradigm has the potential of improving current buyer/supplier systems. The difference in their satisfaction with the two different models (see Table 36), identifies that practitioners feel the change is needed and will improve the customer satisfaction and value of projects.

5 Usability and Impact of PIPS/PIRMS Factors on Projects

5.1 Introduction

The previous chapters have identified from literature and industry practitioners the factors that make the PIPS/PIRMS system unique from the traditional buyer/supplier systems. These factors are the reason the PIPS/PIRMS increase customer satisfaction and value on projects. This chapter will reveal the results of case studies performed to identify if (SRQ 4, see Chapter 2): The unique PIPS/PIRMS factors can be used on any type of project and create increased customer satisfaction and value?

The case studies that were performed were in partnership with the following buyers in the United States (Michael et al. 2008; Kashiwagi et al. 2007; Kashiwagi 2012; Little et al. 2012; Kashiwagi & Kashiwagi 2012; Riley & Kashiwagi 2012; PBSRG 2012; Kashiwagi et al. 2010):

- Schering Plough (Private Business) (Doug Hanlon)
- Arizona State University (Public Organization) (John Riley, Adrian Sannier, and Ray Jensen)
- State of Oklahoma (Public Organization) (John Morrison, Scott Schlotthauer, and Steve Hagar)
- University of Idaho (Public Organization) (Tyrone Brooks and Pat Clelland)
- State of Idaho (Public Organization) (Mark Little)

The buyers were the first to implement the PIPS/PIRMS factors in projects. These buyers implemented the unique PIPS/PIRMS factors on 31 projects and 30 different types of services. The author of this research personally was involved in 26 of the 31 projects. For each project all of the unique PIPS/PIRMS factors were implemented. This will be illuminated in the cases.

5.2 Case Studies

5.2.1 Case Study Methodology

Each case study was approached with three main objectives in mind:

- To document if the eight unique PIPS/PIRMS factors were integrated in the buyer/supplier system being used.
- Identify if the customer satisfaction of the project increased, when the PIPS/PIRMS factors were implemented, from the traditional buyer/supplier system used.
- Identify if the value of the project increased, when the PIPS/PIRMS factors were implemented, from the traditional buyer/supplier system used.

To document if the eight unique PIPS/PIRMS factors were integrated in the buyer/supplier system being used, for each case study, the traditional buyer/supplier system being used was documented by identifying which factors the traditional system was using. The factors for the traditional buyer/supplier system were determined from the written published documentation of the organization on their buyer/supplier system. When the eight unique PIPS/PIRMS factors were integrated into the system, it then documented the change in factors used. The only changes to the factors that were seen was the eight unique PIPS/PIRMS factors, and the elimination of any traditional factors that prevented the implementation of any of the PIPS/PIRMS factors.

Customer satisfaction on each case study was performed by either having the buyers rate the traditional buyer/supplier system they used and then having them rate the buyer/supplier system when the unique PIPS/PIRMS factors were integrated into the system or through measurement of the client customer satisfaction of the previous service and then the service after PIPS/PIRMS factors were used. The ratings were performed on a scale of 1-10, 1 being the most dissatisfied and 10 being the most satisfied with the system and the results.

Increased value on each case study was identified by taking the cost of the project using the traditional buyer/supplier system and then taking the decreased cost of the project when the unique PIPS/PIRMS factors were integrated into the buyer/supplier system. Increased value was also measured through documenting additional services that a supplier offered at no cost to the buyer. The services were then converted to a financial value. Any services that could not be converted to a financial value was identified in Appendix C of the Appendices document found at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

Documenting the integration of the factors, the customer satisfaction, and the value of each case study, was accomplished through documenting the following matrix for each case study performed:

- Buyer Organization - The name of the buyer performing the case study
- Case Study - Name of the project being used as a case study
- Traditional Cost - Cost of the project using the traditional buyer/supplier system
- PIPS/PIRMS Cost - Cost of the project when the unique PIPS/PIRMS factors were integrated.
- Savings - The difference between traditional cost and the PIPS/PIRMS cost
- Added Value - Additional value the buyer received when the PIPS/PIRMS factors were integrated into the project.
- Previous Customer Satisfaction (CS) - Customer Satisfaction of the buyer when the traditional buyer/supplier system was performed.
- PIPS/PIRMS Customer Satisfaction (CS) - Customer Satisfaction of the buyer when the PIPS/PIRMS factors were integrated into the project.
- Factors Integrated (F-INT) - If the unique PIPS/PIRMS factors were integrated into the project. This will be identified as a yes or no value.

The case studies are reviewed by organization. The organization will be introduced and then the case studies that the organization performed will be reviewed. The discussion for each organization will follow the identified format:

1. Introduction - Description of organization and PIPS/PIRMS case
2. Implementing the PIPS/PIRMS factors - Identification of the changes they made to their traditional buyer/supplier system.
3. PIPS/PIRMS Factor Results - Performance measurements of the projects that implemented the unique PIPS/PIRMS factors.
4. Conclusion - Lessons learned from implementing the PIPS/PIRMS factors.

For more detailed information on each of the case studies please see Appendix C in the Appendices document found on the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

5.2.2 Schering Plough

Introduction

Schering Plough is a pharmaceutical company that procures about \$57.3 million worth of services a year (Schering Plough, 2008). Schering Plough was acquired by MERCK in the late 2000s. Throughout their growth the company encountered difficulty with their buyer/supplier system and in 2006 decided to use PIPS/PIRMS to see if they could improve the management of their services and the value of delivered services. The optimal goal was to improve the level of services while lowering the price of the services (Kashiwagi 2007).

Some of the problems that Schering Plough had experienced:

- Buyer's expectation of quality from the suppliers was not being met.
- Lack of motivation from suppliers to improve their efficiency and processes.

After hearing about the PIPS/PIRMS, Schering Plough was interested to use the factors in the services arena. Believing that it would:

- Verify the suppliers that were the best value for Schering Plough
- Increase supplier performance and accountability
- Minimize management of the outsourced services
- Increase their buyer satisfaction of outsourced services.

Implementing the PIPS/PIRMS Factors

The following observations were documented at the start of the implementation:

- The implementation of PIPS/PIRMS factors were difficult to integrate into Schering Ploughs buyer/supplier system.
- Education of Schering Plough's procurement, management, and services group was crucial in making the transition to the PIPS/PIRMS factors smooth.

Implementing the unique PIPS/PIRMS factors into the contracting and realization phase of the projects were the most difficult. The problems started to occur as the vendor was required to create the contract. The following observations were documented:

- Suppliers were finding it difficult to identify risks on the project that they did not control and plans to mitigate those risks in a timely manner.
- Rules and regulations that Schering Plough were required to keep and maintain made it difficult for the suppliers to monitor and analyze their own performance.
- Schering Plough managers did not see the need to require the vendor to measure and control the project, as that was usually their function.

The traditional culture of Schering Plough was opposed to the PIPS/PIRMS factors. The following were attributes of the Schering Plough culture (Kashiwagi J., 2007):

- It was the buyers responsibility to ensure the supplier did not make any mistakes. This was done by direction and management of the supplier and inspection of their work.
- The contract was critical to the success of the project because it provided control and leverage over the supplier.
- It is the buyers responsibility to ensure that performance of the supplier is measured and documented at all times.

Despite the difficulty in implementing the PIPS/PIRMS factors, by early 2007 Schering Plough was able to integrate the PIPS/PIRMS factors into their buyer/supplier system.

Table 37 shows the changes made to the traditional buyer/supplier system Schering Plough was using, when PIPS/PIRMS was incorporated.

Table 37: Factor Changes for Schering Plough System

#	Factors	Previous Traditional System	w/ PIPS/PIRMS Factors
1	No-Influence Philosophy		X
2	Seamless contract		X
3	Supplier contract creation		X
4	Pre-planning		X
5	Problem Contracting		X
6	Communication Minimization		X
7	Expert Supplier Model		X
8	Dominant Information		X
9	Planning	X	X
10	Communication		
11	Collaboration and Partnering	X	
12	Shared Accountability		
13	Trust		
14	Multi-Disciplinary Team		
15	Early Supplier Involvement		
16	Senior/Top Management Support		
17	Contract Terms		
18	Long-term contracts/relationships		
19	Defining Roles	X	X
20	Living Scope		
21	Scope of Service	X	
22	Incentives and Penalties		
23	Use Information to make decision		
24	Measurement Tools	X	X
25	Insurance and bonds	X	X
26	Document Structure	X	X
27	Training Program	X	X
28	Stakeholder Management		
29	Delegate Responsibility		
30	Knowledge Management System		
31	Inspection	X	X
32	Buyer Decision Making	X	X
33	Buyer Performance Evaluation	X	X
34	Third Party Certification		
35	Risk Sharing		
36	Project Constraints		
37	Mitigation of Technical Risk	X	
38	Computer Algorithm		
39	Simulation Technology	X	
40	Internal Technology Connection		
41	Master Supplier	X	X
42	System hires an Experienced PM/Facilitator/SCI	X	
43	Quality Surveyor	X	
44	Information Communication Technology	X	X

PIPS/PIRMS Factor Results

The following Tables (Table 38, Table 39, Table 40, Table 41) show the results of the Schering Plough implementation of the PIPS/PIRMS factors into their buyer/supplier system after two years.

Table 38: Schering Plough PIPS/PIRMS Implementation

Criteria	Results
Number of years implementing PIPS/PIRMS Factors	2 years
Number of outsourcing services	12*

*Calibration projects considered only 1 project instead of 3

Table 39: Schering Plough Savings

Service	Annual Savings	Monthly Savings
Bottle Watered	\$48,000	\$4,000
Calibration Admin Support	\$160,000	\$13,333
Calibration Services	\$1,404,000	\$117,000
Calibration Transition Support	\$160,000	\$13,333
Elevators	\$277,000	\$23,083
Laundry Services	\$792,000	\$63,000
Overhead Door Services	\$17,000	\$1,417
Pest Control	\$19,000	\$1,583
Insulation Services	\$133,000	\$11,083
Plant Water Treatment	\$22,449	\$1,871
Scales & Balances	\$225,000	\$18,750
Storeroom Management	\$30,000	\$2,500
Sterilizers/lab Washers	\$10,100	\$842
Table Top Water systems	\$68,354	\$5,696
Total:	\$3,437,903	\$286,492

Table 40: Schering Plough Financial Results

Criteria	Amount
Original Cost of Services	\$6,965,806
PIPS/PIRMS Savings	\$3,437,903
Final Cost of Services	\$3,527,903

Due to Schering Ploughs security requirements and confidentiality agreements, the specific costs of each projects could not be revealed. Schering Plough did allow the savings to be shown. Schering Plough also did not allow the surveying of the clients receiving the services, as it would take effort to get the proper approvals and security clearances. The customer satisfaction of the previous system and the PIPS/PIRMS was performed by the procurement group. Each project was rated by the purchasing director and the contracting officers over the project. The average of the scores were used to

identify the "Previous CS" and the "PIPS/PIRMS CS" for Table 41. The purchasing director and the contracting officers rated all the projects the same.

Table 41: Schering Plough Case Study Tests Matrix

#	Case Study	Traditional Cost	PIPS/PIRMS Cost	Savings	Added Value	Previous CS	PIPS/PIRMS CS	F-INT
1	Bottled Water	-	-	48,000	-	5.467	7.78	Yes
2	Calibration Admin Support	-	-	1,724,000	-	5.467	7.78	Yes
3	Elevators	-	-	277,000	-	5.467	7.78	Yes
4	Laundry Services	1,632,000	840,000	792,000	-	5.467	7.78	Yes
5	Overhead Door Services	-	-	17,000	-	5.467	7.78	Yes
6	Pest Control	-	-	19,000	-	5.467	7.78	Yes
7	Insulation Services	-	-	133,000	-	5.467	7.78	Yes
8	Plant Water Treatment	-	-	22,449	-	5.467	7.78	Yes
9	Scales and Balances	-	-	225,000	-	5.467	7.78	Yes
10	Storeroom Management	-	-	30,000	-	5.467	7.78	Yes
11	Sterilizers / Lab Washers	-	-	10,100	-	5.467	7.78	Yes
12	Table Top Water Systems	-	-	68,354	-	5.467	7.78	Yes

Conclusion

Schering Plough was able to successfully integrate the PIPS/PIRMS factors in their buyer/supplier system on 12 projects in the course of 2 years. The results of the projects found that when the PIPS/PIRMS factors were integrated into the buyer/supplier system it increased the customer satisfaction and the value of the services (see Table 40).

5.2.3 State of Oklahoma

Introduction

The State of Oklahoma started implementing the PIPS/PIRMS in 2009. The State was introduced to it at a NIGP meeting, where the State's architect, John Morrison, heard Dr. Kashiwagi. The State's construction and properties (CAP) division, a part of the Department of Centralized Services (DCS), became a research client to PBSRG at Arizona State University. CAP then introduced the process to the Purchasing division of the DCS, in charge of procuring all of the non-construction services in the State, who then started implementing PIPS/PIRMS factors on projects the same year. The State of Oklahoma is the only State in the U.S. to have implemented the PIPS/PIRMS factors into both construction and non-construction services.

Implementing the Unique PIPS/PIRMS Factors

The State of Oklahoma had no problems in integrating the unique PIPS/PIRMS factors into their buyer/supplier system. The traditional State of Oklahoma system had no requirements or regulation restricting any of the factors. Some of the reasons contributing to the ease of implementation are as follows:

- Extensive training was given to the suppliers, managers, and internal State clients before implementation.
- Technical experts were not employed to manage their projects.
- The State implemented the PIPS/PIRMS factors on projects where the client understood the paradigm shift.

To implement the 8 PIPS/PIRMS factors Table 42 shows the changes made to the State of Oklahoma traditional buyer/supplier system.

Table 42: Factor Changes for the State of Oklahoma System

#	Factors	Previous Traditional System	w/ PIPS/PIRMS Factors
1	No-Influence Philosophy		X
2	Seamless contract		X
3	Supplier contract creation		X
4	Pre-planning		X
5	Problem Contracting		X
6	Communication Minimization		X
7	Expert Supplier Model		X
8	Dominant Information		X
9	Planning		
10	Communication		
11	Collaboration and Partnering		
12	Shared Accountability		
13	Trust		
14	Multi-Disciplinary Team		
15	Early Supplier Involvement		
16	Senior/Top Management Support		
17	Contract Terms	X	
18	Long-term contracts/relationships		
19	Defining Roles	X	
20	Living Scope		
21	Scope of Service	X	
22	Incentives and Penalties		
23	Use Information to make decision		
24	Measurement Tools		
25	Insurance and bonds	X	X
26	Document Structure		
27	Training Program		
28	Stakeholder Management		
29	Delegate Responsibility		
30	Knowledge Management System		
31	Inspection	X	
32	Buyer Decision Making	X	
33	Buyer Performance Evaluation	X	
34	Third Party Certification		
35	Risk Sharing		
36	Project Constraints		
37	Mitigation of Technical Risk		
38	Computer Algorithm		
39	Simulation Technology		
40	Internal Technology Connection		
41	Master Supplier		
42	System hires an Experienced PM/Facilitator/SCI		
43	Quality Surveyor	X	
44	Information Communication Technology		

PIPS/PIRMS Factors Results

Table 43 shows a summary of the results of the PIPS/PIRMS implementations.

Table 43: State of Oklahoma Case Study Tests Matrix

#	Case Study	Traditional Cost	PIPS/PIRMS Cost	Savings	Added Value	Previous CS	PIPS/PIRMS CS	F-INT
1	Computer to Plate	120,000	111,769	8,231	-	1.2	9.33	Yes
2	State Light Bulb and Fixture contract	1,105,980	709,678	396,302	-	1.2	9.33	Yes
3	Emergency Hazardous Waste Removal contract	3,252,336	941,873	2,310,463	-	1.2	9.67	Yes
4	Electronic Document Management Services*	0	0	-	30,000	1.1	9.67	Yes
5	Education: Grades 3-8 Testing	33,398,370	28,498,370	4,900,000	-	4.1	9.33	Yes
6	Commercial off the shelf Tax Software (COTS-ITS)	40,000,000	28,000,000	12,000,000	-	4.1	9.56	Yes
7	Mental Health Services	22,205,040	12,932,775	9,272,265	-	4.1	9.56	Yes
8	Workforce Enhancement	240,000	230,000	10,000	-	5.0	9.28	Yes
9	Stimulus Measurement	500,000	409,575	90,425	-	5.0	9.28	Yes

*Savings due to elimination of an 1/2 FTE

The State of Oklahoma saved \$29.01M (including added value on Table 43) on the 9 projects they used the PIPS/PIRMS factors on. The State has seen increased efficiencies with implementing the PIPS/PIRMS factors in the following ways:

- The suppliers have been given the ability to identify solutions that add more value (decrease cost and increase value)
- The State's procurement and management personnel can take on an increased work load, due to minimal protests and problems with the suppliers.
- The suppliers have identified and resolved many problems due to the required pre-planning
- The State does not need to expend resources to gather and obtain technical expertise, due to relying on the suppliers for the information.
- The State spends less time and resources on legal issues.

Conclusion

The State of Oklahoma implemented the unique PIRMS factors on nine projects. The projects showed an increase in customer satisfaction and value. These case studies were the easiest to run as the State's traditional process did not have any practices that impeded the eight unique PIRMS factors.

5.2.4 Arizona State University (ASU)

Introduction

Ray Jensen, the Associate Vice President for University Business Services at Arizona State University, was introduced to the PIPS/PIRMS process in 1996. At the time Ray Jensen and ASU decided that they would not benefit from the process. Ray Jensen explains that the reason for this was because they felt that, “many of his ideas were intuitive and we were doing them in our own way.” In 2006, Ray Jensen and John Riley, the ASU Executive Director of Purchasing and Business Services, were given an update briefing of the PIPS/PIRMS and the updates and modifications that had occurred in the last ten years. Soon after, ASU decided to start testing the PIPS/PIRMS. One of the first projects ASU decided to implement the PIPS/PIRMS factors on was a \$400M, ten year, Dining Service contract. ASU saw amazing benefits and efficiencies due to the PIPS/PIRMS factors. The University then began testing the PIPS/PIRMS on multiple ICT projects and a wide variety of services.

Implementing PIPS/PIRMS Factors

Table 44 shows the changes made to the traditional ASU buyer/supplier system when the 8 PIPS/PIRMS factors were implemented.

The documented factors shown for ASU's traditional process in Table 44, is different than what is shown in Chapter 3. The reason for this, is due to many factors not being documented in ASU's literature or any written document, that were discovered when running the case study tests. The factors were confirmed with John Riley the university's procurement director.

Table 44:Factor Changes for the Arizona State University System

#	Factors	Previous Traditional System	w/ PIPS/PIRMS Factors
1	No-Influence Philosophy		X
2	Seamless contract		X
3	Supplier contract creation		X
4	Pre-planning		X
5	Problem Contracting		X
6	Communication Minimization		X
7	Expert Supplier Model		X
8	Dominant Information		X
9	Planning	X	X
10	Communication	X	
11	Collaboration and Partnering	X	
12	Shared Accountability	X	
13	Trust	X	
14	Multi-Disciplinary Team	X	X
15	Early Supplier Involvement	X	X
16	Senior/Top Management Support	X	X
17	Contract Terms	X	X
18	Long-term contracts/relationships	X	X
19	Defining Roles		
20	Living Scope		
21	Scope of Service	X	
22	Incentives and Penalties	X	
23	Use Information to make decision	X	
24	Measurement Tools	X	X
25	Insurance and bonds		
26	Document Structure		
27	Training Program		
28	Stakeholder Management		
29	Delegate Responsibility		
30	Knowledge Management System	X	
31	Inspection	X	
32	Buyer Decision Making		
33	Buyer Performance Evaluation		
34	Third Party Certification		
35	Risk Sharing	X	
36	Project Constraints	X	X
37	Mitigation of Technical Risk	X	
38	Computer Algorithm		
39	Simulation Technology		
40	Internal Technology Connection	X	X
41	Master Supplier	X	X
42	System hires an Experienced PM/Facilitator/SCI		
43	Quality Surveyor		
44	Information Communication Technology		

PIPS/PIRMS Factor Results

Arizona State University was able to implement 8 projects with the unique PIRMS/PIPS factors. The results are seen in Table 45.

Table 45: Arizona State University Case Study Tests Matrix

#	Case Study	Traditional Cost	PIPS/PIRMS Cost	Savings	Added Value	Previous CS	PIPS/PIRMS CS	F-INT
1	Information Technology Network	69,909,670	62,500,000	7,409,670	7,409,670	3.015	9.25	Yes
2	Tri University Furniture Contract	18,600,000	16,100,000	2,500,000	-	7	9.3	Yes
3	Public Relations	-	-	0	27,000,000	1	10	Yes
4	Help Desk	7,014,000	6,600,000	414,000	-	9.23	9.66	Yes
5	Dining Services	-	-	0	32,545,077	5.2	7.1	Yes
6	Bookstore Services	-	-	29,000,000	-	1	10	Yes
7	Document Services	UNK	UNK	0	117,502	1	10	Yes
8	Television Services	6,169,140	0	6,169,140	2,690,000	1	7.5	Yes

The purchasing department found the following:

- The quality of service always improved when the PIPS/PIRMS Factors was implemented.
- The services and projects all were performed on-time and on-budget.
- All the services were performed for a lower cost than previously under their traditional buyer/supplier system.

ASU did run an additional project for their data center. The project was eventually cancelled, due to the vendor not being able to show their expertise during the contract creation stage. The University decided that the cost of the service was not worth the expertise they were receiving. This ended up saving the University millions of dollars on new services and equipment. This was a lesson learned for the University, that the PIPS/PIRMS factors would help them identify if a service was worth purchasing.

Conclusion

ASU identified over \$115M savings and added value on the 8 projects that they ran in this study. The University did find that education was critical to ensure the success of the projects with the unique PIPS/PIRMS factors. In fact, ASU ensured that on 3 services the suppliers received additional training and education throughout the term of their contract.

5.2.5 University of Idaho

Introduction

The University of Idaho (UI) ran one project with the PIPS/PIRMS factors. They received information on the Arizona State University dining service project and wanted to implement the factors at their university for the same service. The Assistant Vice President (AVP) of auxiliary services, Tyrone Brooks, led the effort at the University.

Implementing PIPS/PIRMS Factors

Table 46 shows the changes that were made to the traditional buyer/supplier system when implementing the PIPS/PIRMS factors.

Table 46: Factor Changes for UI System

#	Factors	Previous Traditional System	w/ PIPS/PIRMS Factors
1	No-Influence Philosophy		X
2	Seamless contract		X
3	Supplier contract creation		X
4	Pre-planning		X
5	Problem Contracting		X
6	Communication Minimization		X
7	Expert Supplier Model		X
8	Dominant Information		X
9	Planning		
10	Communication	X	
11	Collaboration and Partnering	X	
12	Shared Accountability		
13	Trust		
14	Multi-Disciplinary Team		
15	Early Supplier Involvement		
16	Senior/Top Management Support		
17	Contract Terms	X	
18	Long-term contracts/relationships		
19	Defining Roles		
20	Living Scope		
21	Scope of Service	X	
22	Incentives and Penalties		
23	Use Information to make decision		
24	Measurement Tools	X	X
25	Insurance and bonds	X	X
26	Document Structure		
27	Training Program		
28	Stakeholder Management	X	X
29	Delegate Responsibility		
30	Knowledge Management System		
31	Inspection		
32	Buyer Decision Making		
33	Buyer Performance Evaluation		
34	Third Party Certification		
35	Risk Sharing		
36	Project Constraints		
37	Mitigation of Technical Risk	X	
38	Computer Algorithm		
39	Simulation Technology		
40	Internal Technology Connection	X	
41	Master Supplier		
42	System hires an Experienced PM/Facilitator/SCI		
43	Quality Surveyor		
44	Information Communication Technology	X	X

The UI did not have as much support implementing the PIPS/PIRMS factors on their project as the other organizations that performed projects. This caused the UI to not implement the "Supplier Contract Creation" factor at first. For the first six months of the

project the University used a contract that they created. After 6 months they identified that they were having problems with the project, and decided to implement the "Supplier Contract Creation" factor. The University allowed the contract to be changed and let the supplier make the changes they thought were required. UI identified that the "Supplier Contract Creation" factor is necessary for the buyer/supplier system to be successful.

PIPS/PIRMS Factor Results

The results of the UI Dining project is shown in Table 47.

Table 47: University of Idaho Case Study Test Matrix

#	Case Study	Traditional Cost	PIPS/PIRMS Cost	Savings	Added Value	Previous CS	PIPS/PIRMS CS	F-INT
1	Dining Services	0	0	0	3,000,000	1	5	Yes

The university saw a value added of \$3M a year due to the increased returns the supplier promised the University.

Conclusion

The University has continued to use the PIPS/PIRMS factors in their buyer/supplier system with the Dining service supplier. They are in the third year of the contract and the university is planning on using the PIPS/PIRMS factors in other projects in the future. This project also identified the importance of the "Supplier Contract Creation" in ensuring increased customer satisfaction and value to projects.

5.2.6 State of Idaho

Introduction

The State of Idaho was first introduced to the PIPS/PIRMS process in early 2008, while attending a training that was being sponsored by Boise State University. After the education the State of Idaho’s purchasing manager agreed to use the 8 PIPS/PIRMS factors in a project.

Implementing PIPS/PIRMS Factors

The changes that were made to the State of Idaho's buyer/supplier system to integrate the PIPS/PIRMS factors is found in Table 48.

Table 48: Factor Changes for the State of Idaho System

#	Factors	Previous Traditional System	w/ PIPS/PIRMS Factors
1	No-Influence Philosophy		X
2	Seamless contract		X
3	Supplier contract creation		X
4	Pre-planning		X
5	Problem Contracting		X
6	Communication Minimization		X
7	Expert Supplier Model		X
8	Dominant Information		X
9	Planning		
10	Communication		
11	Collaboration and Partnering		
12	Shared Accountability		
13	Trust		
14	Multi-Disciplinary Team		
15	Early Supplier Involvement		
16	Senior/Top Management Support		
17	Contract Terms		
18	Long-term contracts/relationships		
19	Defining Roles		
20	Living Scope		
21	Scope of Service	X	
22	Incentives and Penalties	X	
23	Use Information to make decision		
24	Measurement Tools	X	X
25	Insurance and bonds	X	
26	Document Structure	X	X
27	Training Program		
28	Stakeholder Management		
29	Delegate Responsibility		
30	Knowledge Management System		
31	Inspection	X	X
32	Buyer Decision Making		
33	Buyer Performance Evaluation	X	X
34	Third Party Certification	X	X
35	Risk Sharing		
36	Project Constraints		
37	Mitigation of Technical Risk		
38	Computer Algorithm		
39	Simulation Technology		
40	Internal Technology Connection		
41	Master Supplier		
42	System hires an Experienced PM/Facilitator/SCI		
43	Quality Surveyor		
44	Information Communication Technology		

The project that the State of Idaho implemented the PIPS/PIRMS factors on was for student healthcare insurance. This project involved four Universities in the State (Boise State University, Idaho State University, Eastern Idaho Technical College, and Lewis

Clark State College). Due to the many participants, it was more difficult to implement the PIPS/PIRMS factors into the project. On this project two PIPS/PIRMS factors were not implemented at first: Seamless contract and Expert Supplier Model. These two factors would be implemented after the State of Idaho felt they were having problems with customer satisfaction and documentation of the project's performance.

PIPS/PIRMS Factor Results

The result of the State of Idaho's case study is found in Table 49.

Table 49: State of Idaho Case Study Test Matrix

#	Buyer Organization	Case Study	Traditional Cost	PIPS/PIRMS Cost	Savings	Added Value	Previous CS	PIPS/PIRMS CS
1	State of Idaho	SHIP Insurance	36,000,000	28,440,000	7,560,000	-	5.85	6.45

The State of Idaho not only received \$7.56M in savings for implementing the factors, but also found that customer satisfaction increased. After the first year of the contract they also discovered that student insurance premiums decreased by 2% for individuals and 19% for spouses and dependants. The supplier was providing better service for a lower cost to the students and the Universities.

Conclusion

The State of Idaho implemented the unique PIPS/PIRMS factors on one project. They found it difficult to implement all of the factors into the project at first. The State of Idaho felt that the two factors they did not implement at first (Seamless contract and Expert Supplier Model) were needed to create increased customer satisfaction and value to the project.

5.3 Adaption of Unique PIPS/PIRMS Factor

The PIPS/PIRMS factors were tracked on every case project. Even though each buyer made minor adjustments in how they implemented the PIPS/PIRMS factors, in general, they followed the same steps and procedures. This would include education on the PIPS/PIRMS factors and how it would affect the buyer/supplier relationship. The following identifies each unique PIPS/PIRMS factor and how it was implemented in the projects to finalize a contract with the supplier and also manage the supplier after the contract was signed (Unique PIPS/PIRMS Factor - How factor was implemented):

1. No-influence, no-control, no management philosophy- The buyer released control of the project to the supplier through minimizing direction and control.
2. Seamless contract- Contract was used as a risk minimizing document, instead of a legal/regulatory/control document.

3. Supplier contract creation- The supplier was required to create the contract and the buyer was required to approve it.
4. Pre-planning- Supplier was required to take care of all pre-planning requirements before the contract was signed.
5. Problem Contracting - The buyer only relayed intent and expectations to the supplier and did not provide a scope of work for the project.
6. Communication Minimization- Communication on the projects between the buyer and supplier were minimized.
7. Expert Supplier Model- The suppliers were expected only to minimize risk that they did not control, they were assumed to have no technical risk.
8. Dominant Information - Information communicated between the buyer and supplier, were required to be in simple, clear, and non-technical terms.

5.4 Case Study Conclusion

The PIPS/PIRMS factors were tested with 5 different buyers in the U.S. on 31 projects, with 30 unique services. All buyers were able to integrate the factors into their buyer/supplier systems.

The case studies that were the closest to using only the PIPS/PIRMS factors were the projects ran by the State of Oklahoma. The State of Oklahoma only used the traditional factor of *Insurance and Bonds*, with the PIPS/PIRMS factors. The performance of the Oklahoma tests were some of the most successful tests that were documented in this study.

To identify the impact the PIPS/PIRMS factor's had on an individual service there were 4 main criteria that were looked at:

- Cost of the service - the amount of money a buyer paid for the service
- Added Value - the amount of money a supplier provided to the buyer for commissions, shared cost savings, or discounts.
- Customer Satisfaction - The satisfaction of the buyer with the performance of the supplier's service.
- Quality of Service - Additional service options and improvements that were of value to the buyer, that could not be expressed in terms of money or customer satisfaction.

The following tables (50 and 51) shows the overall impact of the PIPS/PIRMS factors, by research partner, by comparing three out of the four impact criteria to the Traditional buyer/supplier system.

Table 50: Overall PIPS/PIRMS Results by Buyer (Part 1)

Criteria	Schering Plough		State of Oklahoma		Arizona State University	
	Traditional	PIRMS Factors	Traditional	PIRMS Factors	Traditional	PIRMS Factors
# of outsourced Services	12		9		8	
Cost of services	\$6,965,806	\$3,527,903	\$100,821,726	\$71,834,040	\$130,692,810	\$85,200,000
Added Value	-	-	-	-	-	\$69,762,248.60
Average Customer Satisfaction (CS)	5.47	7.78	3.00	9.44	3.56	9.10

Table 51: Overall PIPS/PIRMS Results by Buyer (Part 2)

Criteria	Idaho State		University of Idaho	
	Traditional	PIRMS Factors	Traditional	PIRMS Factors
# of outsourced Services	1		1	
Cost of services	\$36,000,000	\$28,440,000	\$0	\$0
Added Value	-	-	-	\$3,000,000.00
Average Customer Satisfaction (CS)	4.12	8.75	1.00	5.00

The impact that the PIPS/PIRMS factors had on the 31 services when compared to the Traditional buyer/supplier systems is:

- Cost of services decreased on average by 31%
- Suppliers were able to offer the buyer 38.5% more value, totalling up to \$72.76M.
- The average customer satisfaction of the service being provided increased by 4.59 points on a 1-10 scale (134% greater than the traditional customer satisfaction rating).

The results of the case study research answered the fourth and last Sub-Research questions found in Chapter 2: Can the unique PIPS/PIRMS factors be used on any type of project to create increased customer satisfaction and value. The case study results indicate that the PIPS/PIRMS factors does create increased customer satisfaction and value on projects (Table 52). The PIPS/PIRMS factors also created success in terms of time and schedule, as all projects were completed on-time or ahead of schedule.

Table 52: Overall PIPS/PIRMS Results

Criteria	Overall Comparison	
	Traditional	PIRMS Factors
# of outsourced Services	31	
Cost of services	\$274,480,342	\$189,001,943
Added Value	-	\$72,762,248.60
Average Customer Satisfaction (CS)	3.43	8.02

To identify the impact that the PIPS/PIRMS factors had on the quality of the services a matrix was created to show the additional work, benefits, and improvements given after the PIPS/PIRMS factors were implemented on the service. The author found that only 15 of the services showed additional improvements and benefits (excluding cost and customer satisfaction) after the PIPS/PIRMS factors were implemented, details to this information can be found in the Appendix C found in the Appendices document located at the following website: <http://pbsrg.com/pips-pirms-factor-documents/>.

The case studies performed discovered that:

- The identified unique PIPS/PIRMS factors from the literature search can be implemented in other industries buyer/supplier systems.
- The identified unique PIPS/PIRMS factors do increase the customer satisfaction and the value of projects.

6 Conclusion

6.1 Introduction

This research proposed that by investigating the PIPS/PIRMS system additional knowledge could be discovered to improve buyer/supplier systems. To ensure valid results, questions were formulated to help better define the objectives and structure of the study. The main question proposed was: *What factors in PIPS/PIRMS that are different from Traditional buyer/supplier systems could be creating increased customer satisfaction and value on projects?*

The answer to this question was divided into 4 main parts devised into the following sub-research questions (SRQs):

1. What factors in PIPS/PIRMS are different from traditional buyer/supplier systems?
2. Is there evidence that practitioners feel PIPS/PIRMS factors are different from other buyer/supplier systems?
3. Is there evidence that practitioners feel the unique PIPS/PIRMS factors create increased customer satisfaction (CS) and value on projects?
4. Can the unique PIPS/PIRMS factors be used on any type of project and create increased customer satisfaction (CS) and value?

This research started in 2006. Each step of this research was able to provide answers to each of the questions identified above. The answers to the questions identified exactly what caused PIPS/PIRMS to create increased customer satisfaction and value on projects.

This section reviews each Sub-Research Question (SRQ) and the answer that the research provided. The SRQs were related to the methodology of the research as follows (SRQ # - Research Methodology):

1. SRQ 1 - To identify what factors in PIPS/PIRMS were different than traditional buyer/supplier interaction systems a literature research was carried out identifying factors in PIPS/PIRMS and Traditional systems (i.e. all other systems) and then comparing the findings to identify the differences (i.e. unique PIPS/PIRMS factors).
2. SRQ 2 - To validate if practitioners agreed that the identified PIPS/PIRMS factors were unique from traditional buyer/supplier systems, an exploratory survey research was performed to practitioners that were exposed to both a traditional system and the PIPS/PIRMS model.
3. SRQ 3 - With the exploratory survey research performed for SRQ 2 questions were asked to practitioners to identify if they also felt the unique PIPS/PIRMS factors could improve customer satisfaction and value (in terms of cost, time, and quality) on projects.
4. SRQ 4 - A case study research was performed to see if the unique PIPS/PIRMS factors could be used on any type of project and create increased customer satisfaction and value.

The research was able to identify the unique factors of the PIPS/PIRMS system and validate that the factors identified did increase the customer satisfaction and value of projects. The research is still tracking many of the services that are still adhering to the PIPS/PIRMS system factors.

6.2 SRQ 1 - What Factors in PIPS/PIRMS are Different from Traditional Buyer/Supplier Systems?

SRQ 1 was answered through a literature research. This research consisted of the following:

- Review of literature in the construction industry for buyer/supplier systems.
- Review of literature for major buyer/supplier theories (i.e. supply chain management, lean, TQM, etc.)
- Review of buyer/supplier system documentation for 10 organizations in the U.S.
- Review of literature for PIPS/PIRMS model.

The literature search identified 36 major factors found in traditional buyer/supplier systems and 13 major factors found in the PIPS/PIRMS model. After comparing PIPS/PIRMS to traditional buyer/supplier systems it was found that there were eight main factors that separated PIPS/PIRMS from traditional systems:

- No-influence, no-control, no management philosophy
- Seamless contract
- Supplier contract creation
- Pre-planning
- Problem Contracting
- Communication Minimization
- Expert Supplier Model
- Dominant Information

The research identified that some of the academic publications identified similar ideas to the unique PIPS/PIRMS factors, such as: Pre-planning, communication minimization, and problem contracting. On the other hand, the researcher could not find anything comparable to the remaining PIPS/PIRMS factors in the industry. The idea of a no-influence or no-control management philosophy went against all the leading buyer/supplier systems. This is shown in Figure 17.

The following are the main conclusions concerning the uniqueness of the PIPS/PIRMS factors:

- No other system identified that the buyer should release all control mechanisms (i.e. contracts, rules, requirements, oversight, etc.) and minimize their management of the supplier.
- No other system required the supplier to have a plan before contract signing, mitigate risk they did not control, and use the contract as the mechanism to protect the supplier and minimize risk for the buyer.

- No other system focuses on eliminating the sharing of technical details with the client, and forces all information to be dominant (i.e. simple, clear, and succinct)
- The idea that the supplier is the proposer and the buyer is the acceptor of the offer is foreign to usual buyer/supplier systems.

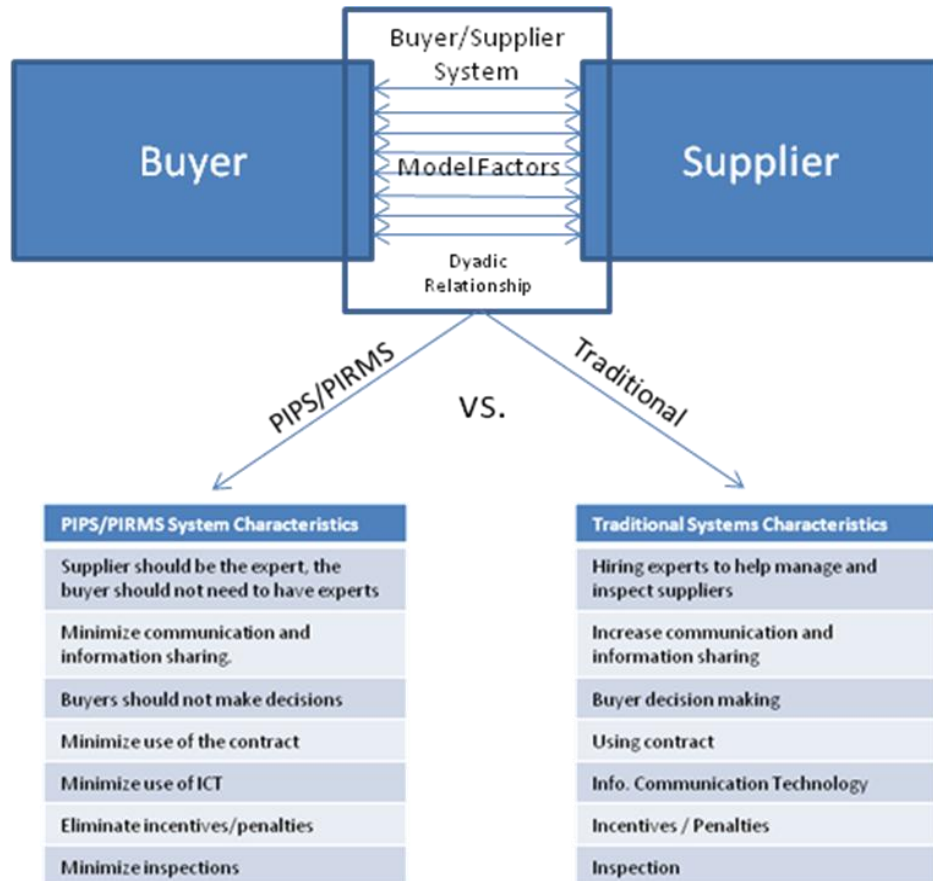


Figure 17: PIPS/PIRMS vs. Traditional Buyer/Supplier Systems

6.3 SRQ 2 - Is There Evidence that Practitioners Feel PIPS/PIRMS Factors are Different from Other Buyer/Supplier Systems?

SRQ 2 was answered with an exploratory survey research. Practitioners in the construction and service industries were asked to identify if they agreed with the literature research results, in that they also felt that the identified 8 PIPS/PIRMS factors were unique. The results of the 2011 and 2012 surveys and the similarity in their results showed that there was evidence that practitioners might feel PIPS/PIRMS factors were different from other buyer/supplier systems. Table 53 also shows the percent of the practitioners that agreed the PIPS/PIRMS factors were unique.

Table 53: PIPS/PIRMS Factors Uniqueness		
PIPS/PIRMS Factor	% of Practitioners that felt PIPS/PIRMS factor was unique	Average 1-10 rating of each factor
No-influence, no-control, no management philosophy	82%	8.61
Seamless contract	86%	8.82
Supplier contract creation	74%	8.07
Pre-planning	83%	8.70
Problem Contracting	56%	6.52
Communication Minimization	69%	7.60
Expert Supplier Model	81%	8.46
Dominant Information	84%	8.82

6.4 SRQ 3 - Is There Evidence that Practitioners Feel the Unique PIPS/PIRMS Factors Create Increased Customer Satisfaction and Value on Projects?

The exploratory survey research results also went to answer SRQ 3. Table 54 and 55 shows the percent of practitioners that feel each unique PIPS/PIRMS factor can improve the value (cost, time, and quality) on projects. The survey results also indicate that customer satisfaction also increases (Table 56).

Table 54: PIPS/PIRMS Factors Lead to Increased Value		
PIPS/PIRMS Factor	% of Practitioners that felt PIPS/PIRMS factor creates success or increased value on projects	Average 1-10 rating of each factor
No-influence, no-control, no management philosophy	67%	7.68
Seamless contract	70%	7.81
Supplier contract creation	60%	7.32
Pre-planning	72%	8.04
Problem Contracting	48%	6.47
Communication Minimization	61%	7.30
Expert Supplier Model	68%	7.83
Dominant Information	73%	8.06

Survey Part II -Statements 2,3,4,5,6	% of Practitioners Surveyed that Agree with the Statement (Avg. of 2011 and 2012 survey results)
System increases efficiency of the project (terms of cost, time, quality)	79%
Satisfied with the performance of the system	62%
System requires less resources	72%
System brings higher performing suppliers	82%
System is fair	83%
Overall Average	76%

Survey Part II - Statement 3	Average rating of Practitioners for the PIPS/PIRMS factors (Avg. of 2011 and 2012 survey results)	Average rating of Practitioners for Traditional Systems (Avg. of 2011 and 2012 survey results)
Satisfied with the performance of the system	7.29	3.90

The validation of the 8 PIPS/PIRMS factors brings to light a different paradigm for buyer/supplier systems, than what has been documented in academic literature and practiced by industry practitioners. The practitioners agreeing that the factors improve customer satisfaction and value of projects, identifies that this new paradigm has the potential of improving current buyer/supplier systems. The difference in their satisfaction with the two different systems (see Table 36), identifies that practitioners feel the change is needed and will improve the customer satisfaction and value of projects.

6.5 SRQ 4 - Can the Unique PIPS/PIRMS Factors be Used on Any Type of Project and Create Increased Customer Satisfaction and Value?

SRQ 4 was answered through a case study research. Multiple projects were ran implementing the unique PIPS/PIRMS factors with five different clients. The PIPS/PIRMS factors were tested on a total of 31 projects in over 30 different industries including, but not limited to:

- Dining
- Document management
- Information communication technology
- Juvenile
- Health Insurance
- Furniture
- Bookstore
- Light bulb and fixtures
- Printing

- Academic / Educational

The result of the tests showed the PIPS/PIRMS factors resulted in:

- Decreasing the cost of services on average by 31%
- Suppliers were able to offer the buyer 38.5% more value.
- The average customer satisfaction of the service being provided increased by 134%
- 15 of the 31 services realized additional benefits and improvements to their services that they would not have received or were not receiving before (see Chapter 5).

Additional value documented from the case studies were:

- Buyers found that Suppliers were more proactive and were more prepared to deal with unexpected problems.
- Litigation and contract disputes were eliminated.
- When deviation to contract requirements occurred, it was found that the buyer was the cause.

The results of the case study research identified that the 8 PIPS/PIRMS factors were not only able to be implemented on multiple types of projects, but was able to help each buyer increase customer satisfaction and value of their projects (cost, time, and quality), above the traditional buyer/supplier system results.

6.6 Answer to Main Research Question

The research was able to answer each sub-research question. Identifying that unique factors of PIPS/PIRMS and then verifying that the factors can be implemented into any project and improve the customer satisfaction and value of the project. The answer to the main research question, "*What factors in PIPS/PIRMS that are different from Traditional buyer/supplier systems could be creating increased customer satisfaction and value on projects?*," is:

- No-influence, no-control, no management philosophy
- Seamless contract
- Supplier contract creation
- Pre-planning
- Problem Contracting
- Communication Minimization
- Expert Supplier Model
- Dominant Information

6.7 Conclusion

The investigation into the PIPS/PIRMS system has discovered a buyer/supplier system that has not only improved the performance of construction buyer/supplier systems, but has also brought its success into the buyer/supplier systems of multiple industries, with the potential of affecting all industries.

The identification of factors that allow buyers/organizations/managers to potentially eliminate management of their suppliers/employees and ensure improvement in performance and efficiency will allow the world to dramatically increase customer satisfaction, production and quality of all services.

This research has potentially discovered a way to change management and improve efficiency and performance of all services. Although, this research has concluded, the refinement and development of this new process has just begun!

7 Reflection

7.1 Introduction

In reviewing the development and process of this research the researcher identified the following main areas of reflection: The Research Performed (including limitations and improvement suggestions, strengths, and lessons learned), Scientific Contribution, Practical Contribution.

These three identified areas are reviewed in the rest of this section.

7.2 Evaluation of Research Approach

7.2.1 The Research Performed

One of the main aspects of this research is its simplicity. The aim and methodology to complete the research was well structured and direct. This helped to being able to answer the questions from the research results and complete the research successfully. In reflecting upon the research the following will be discussed:

1. Limitations of the research with suggestions on improvement
2. Strengths of the research
3. Lessons learned from the research

7.2.2 Limitations of the Research

This section discusses the limitations of the research. There were three main research methods used for this study (Literature, Exploratory Survey, and Case Study). The limitations will be discussed by research method.

The literature research was performed using only academic databases and articles available to the author, consisting mainly of databases found only in the United States. Even though there were multiple academic databases open to the researcher, the researcher still was not able to locate some academic papers that were identified as relevant to the research. Language was also a barrier, any publication that was not written in English could not be used. The majority of the literature research performed was limited to the construction industry. The only part of the research performed out of the construction industry was ideas and theoretical ideas that the construction industry utilized from other industries.

Partnering with academics in different countries and in different industries would improve the validity of this literature research and make the results more relevant.

To identify practitioners opinions an exploratory survey research was performed, as identified in Chapter 4. Enough information was collected to provide indication for justification of the factors; however, not enough information was collected to have statistical proof. The surveys were performed one (2011) and two years (2012) ago.

During this time the population of PIPS/PIRMS users have increased and the explanation of the factors have changed. Performing another survey research will strengthen the results of this research.

The rating of the surveys were on a 1-10 scale (1-4=disagree, 5=not enough information to know, 6-10=agree), this scale did not give an even amount of disagree options (ratings from 1-4 or 4 options) from agree options (6-10=agree, or 5 options). Additional survey research should give the practitioner a rating scale with the same amount of options for the disagree and agree categories.

The cases researched were performed over the course of six years. The amount of information and control over the case study tests varied, causing differences in the data being collected for each case study. Due to the restraints of some of the organizations that allowed the researcher to implement the eight PIPS/PIRMS factors on their projects, the amount of information available to the researcher and the amount of control on the project was not as much as was desired. For example, the organization: Schering Plough, would not allow the researcher to go straight to the client for their satisfaction (see Chapter 5). For some projects the organizations did not want to release pricing information. For other projects prior performance of the service was not known or in the form that was being measured. Collecting comparable customer satisfaction ratings between each case study was difficult. Additional case studies with organizations that are willing to release and give access to all information required will increase the validity of the case study research results. To perform case studies with more private entities will also increase the relevancy of the results for the private sector, Schering Plough being the only private entity that performed case study tests.

7.2.3 Strengths of the Research

This section will review the strengths of this research. The first strength of the research is the utilization of three different acknowledged research methods. Using three different methods of research that provided information that was consistent in answering the MRQ and SRQs, provides support to the results of this research. The rest of this section will look at the strengths of each of the research methods used.

The literature research performed was able to focus on an industry that was mature enough to have incorporated most of the newer buyer/supplier systems techniques. The researcher also did a literature search on the theories used by the construction industry, which covered the main buyer/supplier system techniques used by all industries. This caused the literature search to have a good reflection of traditional buyer/supplier systems in general, making the literature search relatively comprehensive and complete.

The survey research was effective since the population of practitioners that met the criteria to fill out the exploratory survey was concentrated and known. The exploratory survey was able to be administered to almost all of the known practitioners that were interested in PIPS/PIRMS at the time. The researcher was also able to administer two rounds of the survey, two years in a row (2011 and 2012). This allowed the author to ensure the results were accurate and valid.

The case study research performed had many strengths. The organizations that participated were different types of buyers (Universities, Government agencies, Private sector), allowing for 30 different types of projects to be studied. The number of case study tests performed (31) also proved to provide more validity to the results. The case study tests performed had good documentation, not only on the implementation of the PIPS/PIRMS factors, but also on the previous implementation of the project using a

traditional buyer/supplier system. This allowed the research to identify improvement when the PIPS/PIRMS factors were implemented.

7.2.4 Lessons Learned from the Research

The researcher learned many lessons while carrying out the research work. Some of them were specific to the type of research being performed and some were in regards to research in general.

Lessons learned that are specific to this research will be discussed first. The PIPS/PIRMS system utilizes new ideas that are difficult for practitioners to grasp. For surveying practitioners on the PIPS/PIRMS factors, it is important to simplify them in a way that practitioners can easily identify what the factor means. The two surveys performed taught the researcher what terms are difficult for the practitioners to understand. In future surveys, in regards to the PIPS/PIRMS factors, clearer questions can be formulated. It was also identified that the number of years a practitioner has been exposed to the PIPS/PIRMS ideas matters in their ability to understand the difference between PIPS/PIRMS and traditional processes. Through looking at the case study results it was found that PIPS/PIRMS factors create more success on projects where the buyer does not have expertise in what they are buying and is forced to rely on the supplier.

The author also discovered the following lessons learned in performing research in general. The idea of pre-planning and ensuring all details are covered before beginning a project in the industry is also applicable to research work. The time and effort that is saved by pre-planning is worth the extra time it takes up front. When research is not well planned out, it creates inefficiency and non-transparent results. The author also realized that one of the keys to good research is asking the right question. The right question creates focus and clarity. It can simplify complexity and bring to light additional knowledge. The researcher also found that if an idea or result cannot be explained simply, it is not a valid result.

7.3 Scientific Contribution and Further Research

The purpose of this research was to lay a foundation for a new paradigm of interaction between buyers and suppliers, through looking at buyer/supplier systems. The PIPS/PIRMS model has identified the traditional direction, control, and influence, management as a inefficient model that is preventing all industries of becoming more successful with their projects. This idea will revolutionize buyer/supplier systems and potentially affect how business and management is performed in all aspects. In order for this to occur, there is still much work needed. There are tremendous opportunities to perform additional research that will move this work along. Some potential research ideas/questions are as follows:

Do the 8 PIPS/PIRMS factors also improve efficiency when managing people? The PIPS/PIRMS factors have been found to improve buyer and supplier interaction, will the factors also help on a micro level (manager and worker level)?

Perform a literature search that is not limited to the construction industry to identify if the 8 PIPS/PIRMS factors are unique to all areas. Additional literature research can also be performed in other countries and languages, to increase the relevancy and validity of the results of this research.

Re-survey practitioners using a more developed and tested survey and perform qualitative research. A more simple and accurate survey could be developed using the lessons learned from this research. The survey could be performed in other countries (other than the U.S.) that PIPS/PIRMS has been utilized in (i.e. Netherlands or Canada).

Perform an analysis that identifies the difference between the factors that, major theories teach, what academics publish, and what the industry actually implements. This research will bring to light, correlations between what the industry is currently implementing and what academics are trying to teach new professionals and practitioners.

Perform case studies that identify if the 8 PIPS/PIRMS factors can be successful without any traditional factors being implemented on a project. This will increase the importance and the validity of the factors.

The performing of more case studies to validate the affect PIPS/PIRMS has on a project will help promote the change in paradigm that this research has brought to light.

7.4 Practical Contribution

The research has identified eight factors that have not been recognized by buyer/supplier system theories before. These factors require no effort and additional resources to implement. Any organization would be able to take these factors and implement into their buyer/supplier system.

The biggest obstacle to implementing these eight factors is the ability of people in the organization to understand the 8 factors. For most organizations wishing to implement these 8 factors, education will be needed to assist people in the organization in understanding what the factors are and how they should be implemented.

The potential impact that these factors have on organizations will not only affect the amount of resources required to outsource and manage services, but it will also revolutionize how organizations interact and do business with suppliers. Potentially drastically changing the way procurement and management is performed.

7.5 Conclusion

This research has exposed a new paradigm for interacting with suppliers and potentially changing the landscape of buyer/supplier relationship on both a macro and micro level. The expansion of this model could free up a large amount of resources in companies to be used to further add additional value and service.

It is the author's hope that this research could create a benchmark for a new way to do business and that others will be able to use it to develop a more efficient and value centered society.

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