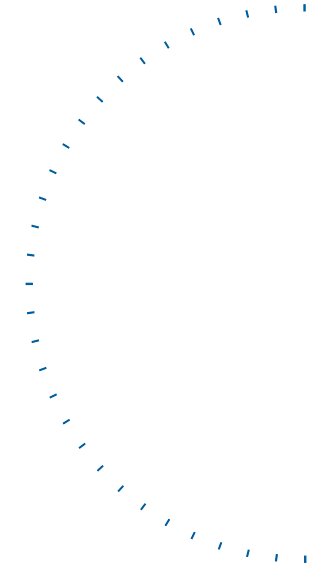




Systems Integration and Information Flow in the Procure-to-Pay Process

*An Industry Survey of Mechanical, Electrical and
Plumbing (MEP) Contractors in North America*

2019





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► Construction Industry and the Productivity Challenge

The construction industry is a significant component of the world economy (13% of the world's GDP) and has been the focus of a number of productivity studies that indicate a gap in productivity growth compared to other industries (i.e. manufacturing, health care, etc.). Globally, construction sector labor productivity growth averaged one percent a year since the year 2000, compared with 2.8 percent for the total world economy and 3.6 percent for manufacturing. If construction productivity were to reach parity with the overall economy, the industry's value could rise by \$1.6 trillion a year. This rise would meet about half of the world's annual infrastructure needs, or boost global GDP by two percent. One third of the opportunity is in the United States, where, since 1945, productivity in manufacturing, retail and agriculture has grown by as much as 1,500 percent, but productivity in construction has risen only slightly over the same period.¹

The root causes of lower productivity are found in three major areas: ¹

- External Forces
- Industry Dynamics
- Firm-level Operational Factors

External forces include: regulation, Industry dynamics include: collaboration and contracting and Firm-level Operational Factors include: on-site execution, technology and capability building. This research focuses on two firm-level operators: **Procurement/Supply Chain Management** and **Technology**. These two areas are highly interrelated; understanding productivity issues in both holistically provides a clearer picture of the underlying productivity gap issues.



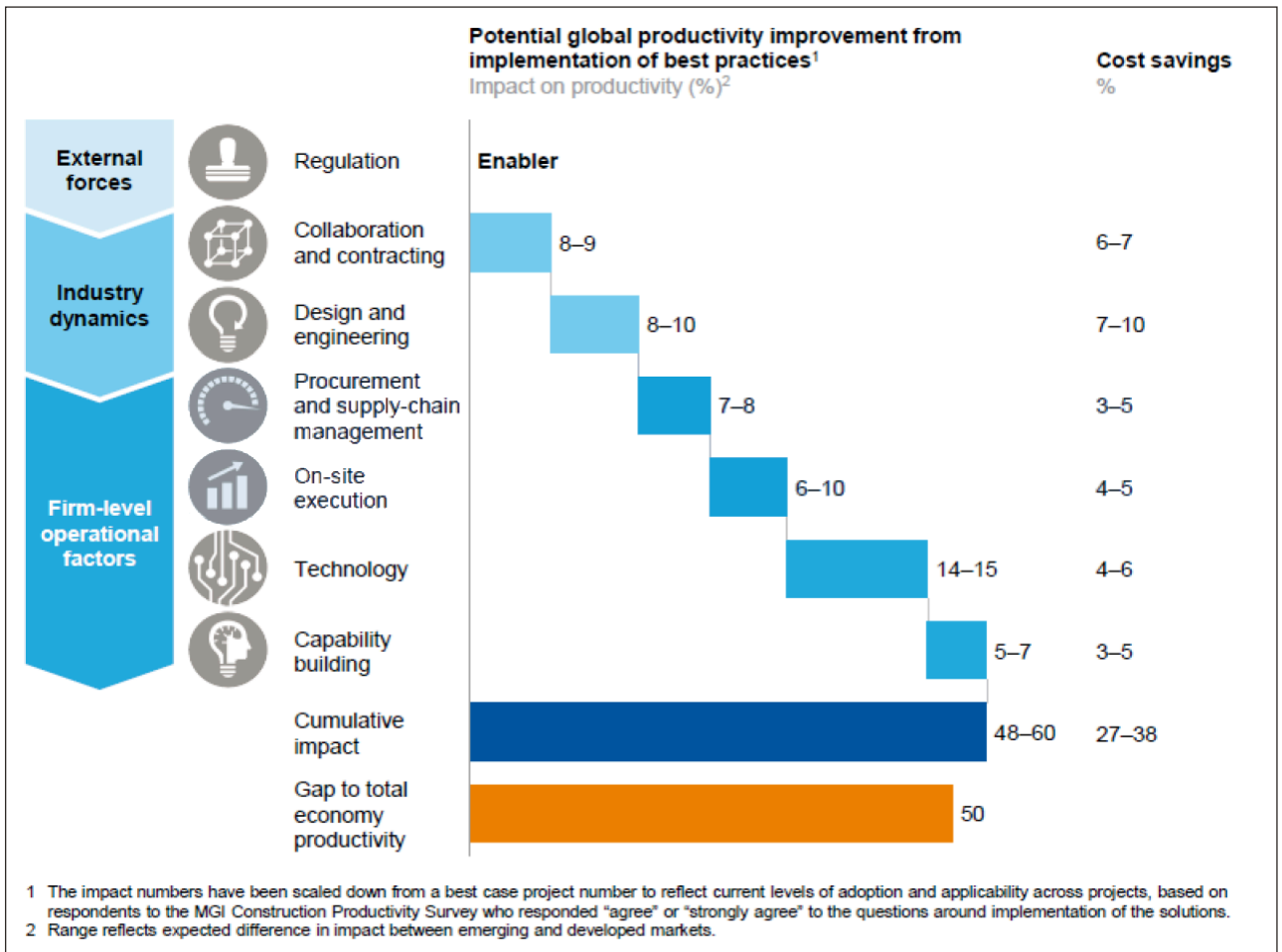
McKinsey Global Institute Diagram: Reinventing construction: a route to higher construction productivity.

¹ Reinventing construction: a route to higher construction productivity – McKinsey Global Institute, February 2017 – Pages 8,9.

► Firm Level Operators

Procurement/Supply Chain Management & Technology

According to McKinsey, Procurement/Supply-Chain management combined with technology contribute to 7-8% and 14-15% of the productivity lag respectively. Efficiency Improvements in these two areas could translate to roughly a 9% increase in value added (\$140 billion per year).





▶ The Study Focus

Mechanical, Electrical, Plumbing (MEP) Contractors

The procure-to-pay process within the construction industry can vary widely based on the type of construction work performed. Mechanical and electrical contractors have complex procurement requirements and deal with a large number of specified material components, which may be sourced from a variety of suppliers/manufacturers.²

Conversely, heavy/civil contractors may order bulk materials (redi-mix, aggregates, sand, etc.) from local suppliers or their own material locations. Due to the wide variety of procurement processes, this study focuses on mechanical/electrical/plumbing (MEP) contractors in North America. By focusing on contractors with similar procurement processes and material requirements, our goal was to provide more targeted and relevant information for the MEP industry.

▶ The Research Objectives

The research focuses on data/information as it flows through both processes and systems during the procure-to-pay (P2P) process. The goal is to, “*understand the efficiency and quality of information flow and its potential effect on productivity during the P2P process*”. The research seeks to gain understanding in the following five main areas:

1. Information systems used during phases of the P2P process
2. The state of integration between systems and data during the P2P process
3. Contractors approaches to procurement (roles and responsibilities) and their perceived efficiency
4. The level of electronic data interchange (EDI) between contractors and their suppliers
5. The efficacy of reporting generated by the data accumulated during the P2P process

² “Why Should You Choose an Automation and Data Partner”: published supplier list by Material Management Software (MMS). MMS, provider of automated purchasing solutions. MMS solution connects to 294 MEP suppliers to enable EDI between contractor and supplier.



▶ The Research Team

In 2017, Viewpoint, a Trimble company, in conjunction with construction industry leaders BKD, FMI Corporation and Carnegie Mellon University, formed a research alliance to study productivity issues in the construction industry. Each member of the alliance brings a unique skill-set to the team:

- **Viewpoint, a Trimble company** – a leading supplier of enterprise resource planning (ERP) solutions to the construction industry. Trimble has more than 6,000 construction clients in North America, EMEA and Australia/New Zealand;
- **FMI Corporation** – FMI has been a trusted partner to the construction industry providing a comprehensive portfolio of services including management consulting and investment banking services;
- **BKD** – BKD's expertise goes well beyond the standard accounting services to include risk management, technology, wealth management and forensic and valuation services; and
- **Carnegie Mellon University** – AECM School. Carnegie Mellon has deep experience in all disciplines of architecture, engineering and construction management. CMU helped establish the research framework and methodology for this study.

▶ Research Format and Responses

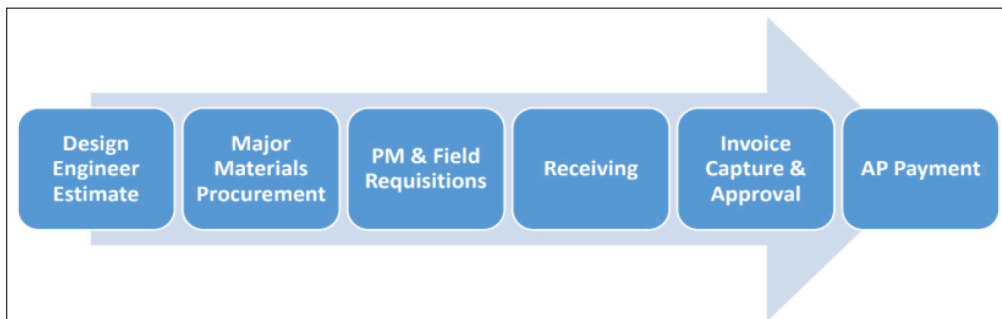
The research team met with eight MEP contractors in order to gain an in-depth understanding into the five areas outlined in the Research Objectives section of this paper. From this initial research, Trimble worked closely with Carnegie Mellon to create a comprehensive electronic MEP industry survey focused on the procure-to-pay process. The Verint electronic survey tool was used and responses were received over a two-month period. This electronic survey contained 31 questions and was sent to 776 MEP contractors, 131 of which provided complete responses to the survey, which we consider to be a statistically significant response.

► The Procure-to-Pay Process – Overview

The procure-to-pay (P2P) process is complex and involves a number of key construction stakeholders. There are six sub-processes, and each process is dependent on its upstream counterparts in order to operate at levels of high-efficiency.

Major Efficiency/Productivity Themes Uncovered in the Industry Survey

1. Disconnected systems contribute to disconnected processes.
2. Information flow is inhibited due to lack of a common data standard.
3. Information flow is inhibited due to wide adoption of material (product code) standards.
4. Procurement practices do not enforce standards, which contributes to inefficient purchasing.
5. EDI between contractors and suppliers is minimal, causing additional work and potentially slowing down processes.
6. Contractors rate their P2P process as average overall (scale 1-5)
7. Communication between stakeholders and adherence to schedule requirements are rated slightly below average. Adherence to guidelines and work accuracy are rated slightly above average.



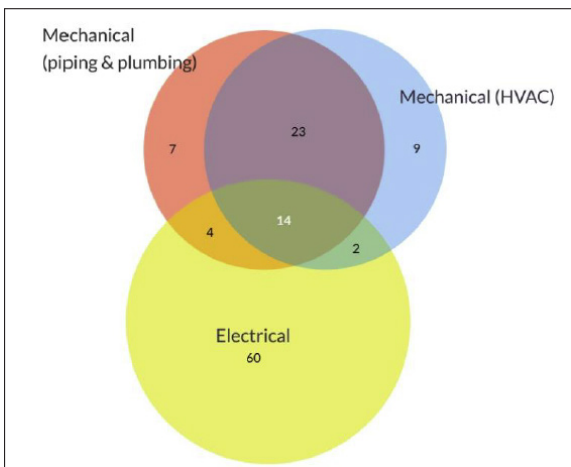
Procure to Pay Process Diagram by Trimble.

► MEP Procure-to-Pay Survey Results and Interpretation of Data

Section 1 – Respondent Demographic

Q: What type of work does your company do?

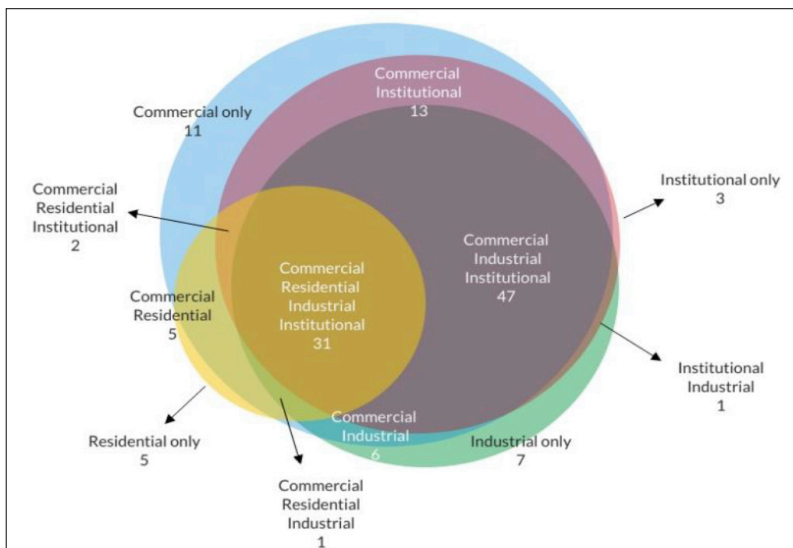
Findings: Nearly half of the respondents reported purely electrical work, while mechanical contractors responded as multi-discipline.



Procure to Pay Survey: May 2019.

Q: What industries (business sectors) does your company serve?

Findings: Contractors serving non-residential markets were most prevalent in the survey.

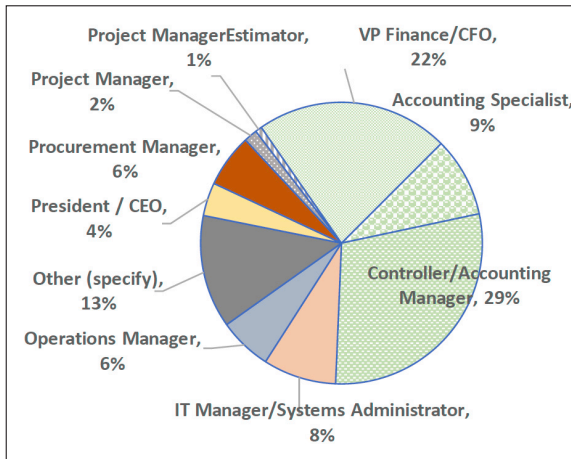


Procure to Pay Survey: May 2019

► Section 1 – Respondent Demographic (continued)

Q: What is your role in the company?

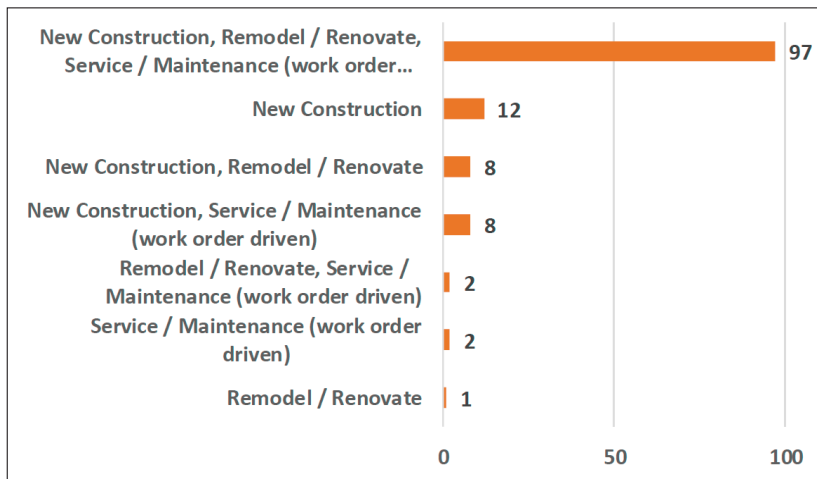
Findings: Respondents were heavily weighted to accounting/finance role – 60%.



Procure to Pay Survey: May 2019.

Q: How do you contract with your customers?

Findings: Nearly 75% (97) of respondents reported performing both new construction and service maintenance work.

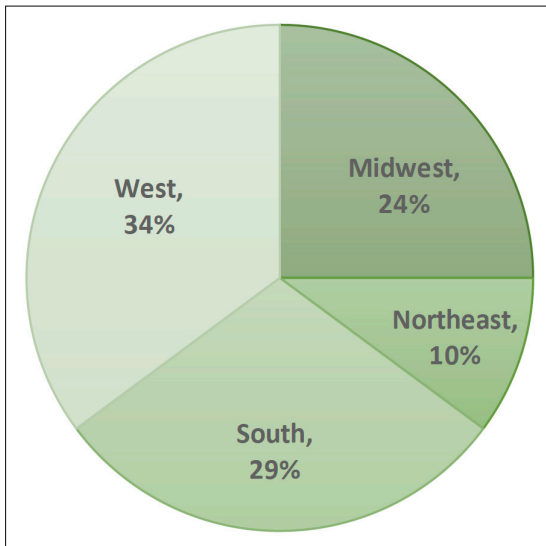


Procure to Pay Survey: May 2019.

▶ **Section 1 – Respondent Demographic** (*continued*)

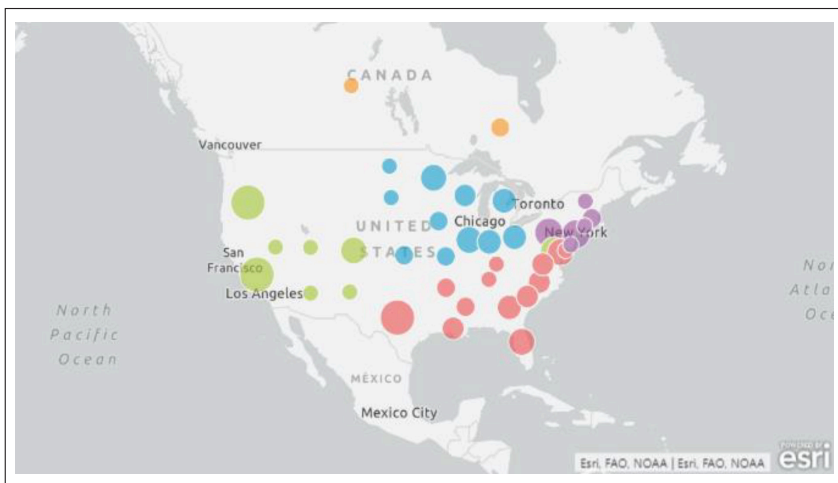
Q: *Where is your company headquarters located?*

Findings: *Survey base was more heavily concentrated in the West and South, with lower concentration in the Northeast.*



3% were unresponsive.

Procure to Pay Survey: May 2019.



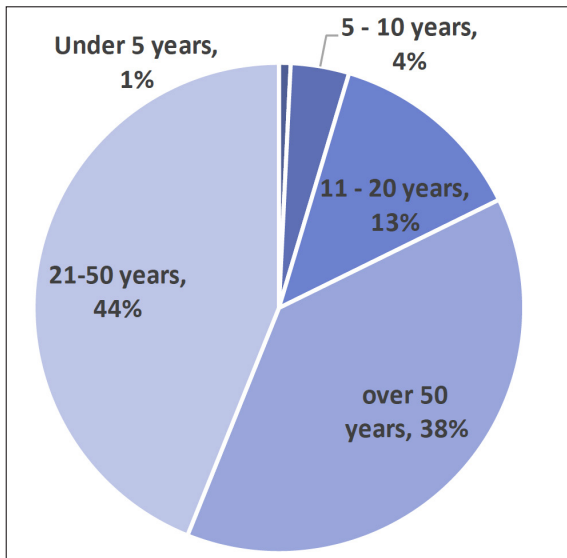
Procure to Pay Survey: May 2019.



▶ **Section 1 – Respondent Demographic** (*continued*)

Q: *How many years has your company been in business?*

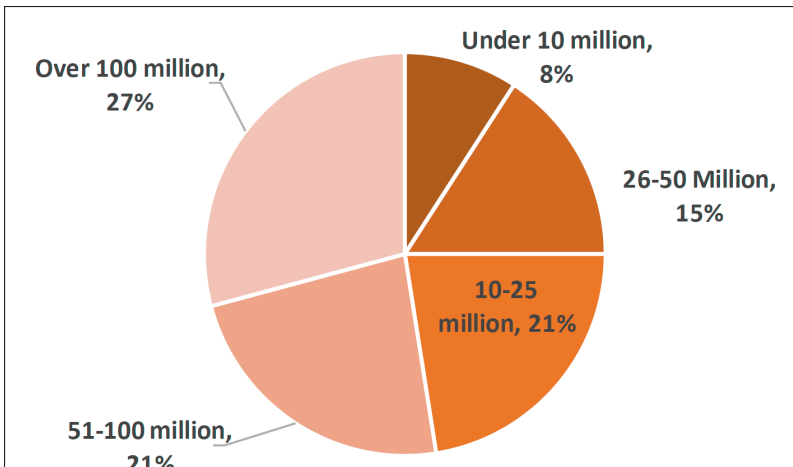
Findings: 82% of respondents reporting being established more than 20 years. Nearly 40% reported being in business 50+ years.



Procure to Pay Survey: May 2019.

Q: *What are your company's annual revenues?*

Findings: For those respondents. >10 million annual revenue range, participation was generally evenly spread between revenue ranges.



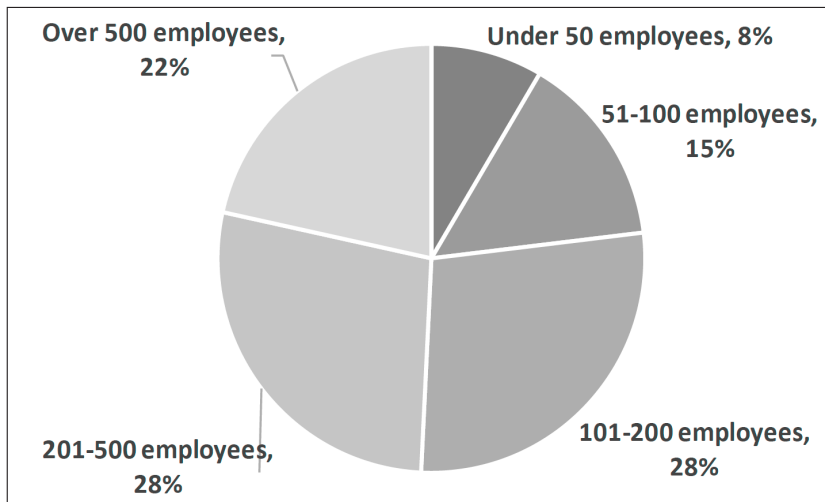
8% were unresponsive.

Procure to Pay Survey: May 2019.

▶ **Section 1 – Respondent Demographic** (*continued*)

Q: *How many people work for your entire company?*

Findings: *Workforce size correlated with company revenue size. (i.e. >10 million in revenue and >50 employees reported 8% participation.)*

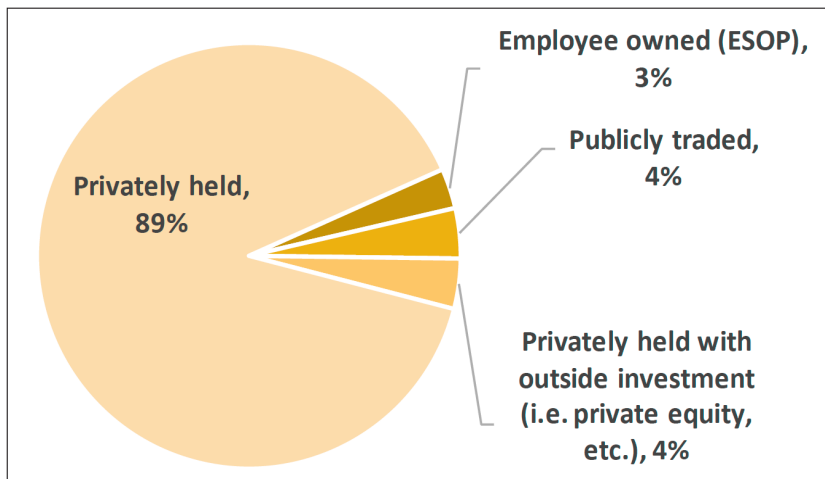


1% didn't know.

Procure to Pay Survey: May 2019.

Q: *What's is your ownership structure?*

Findings: *Respondent companies reported as substantially privately held, with other ownership structures reporting in the 3% range.*



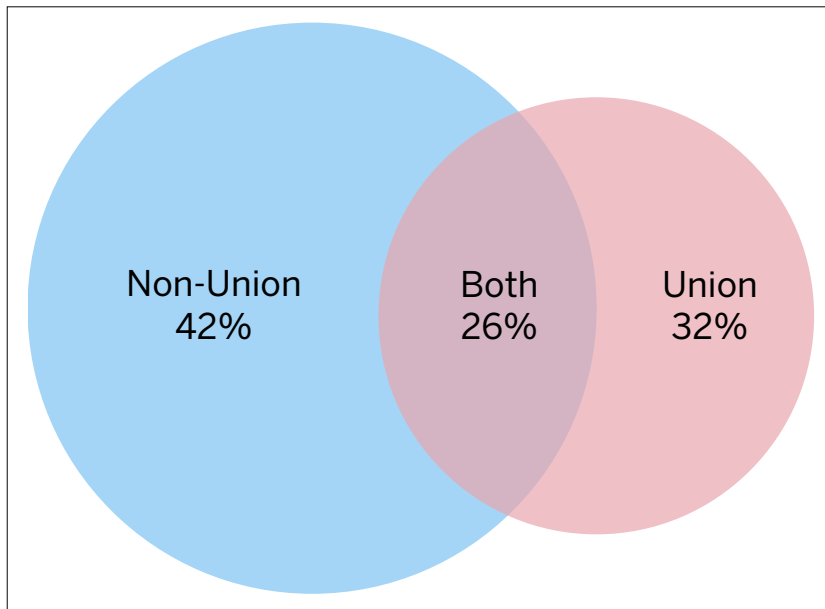
Procure to Pay Survey: May 2019.



▶ **Section 1 – Respondent Demographic** (*continued*)

Q: *What are your company's field labor affiliations?*

Findings: *31% more contractors reported as non-union vs. union. There were a substantial number of companies who reported as double-breasted.*



Procure to Pay Survey: May 2019.

▶ Section 2 – Software Solutions Used in Procure-to-Pay Process

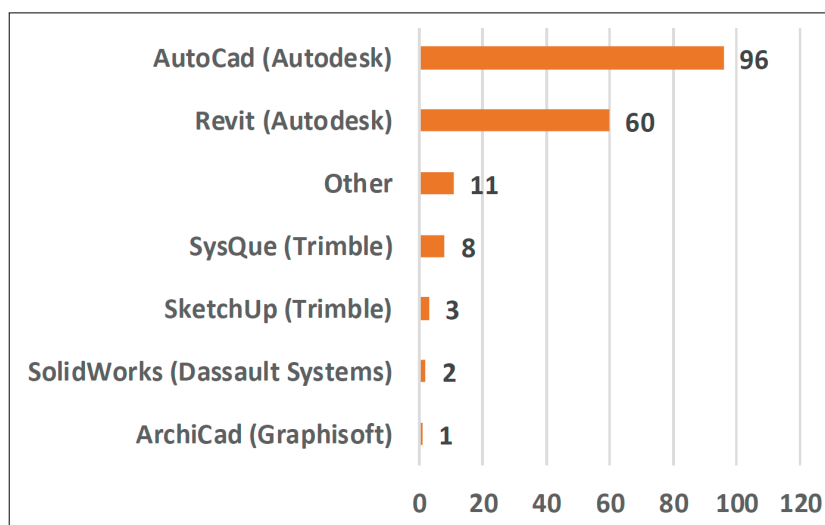
The surveyed contractors were asked what software they used for the following processes:

- Design
- Estimating
- Request For Quote
- Purchasing
- Receiving
- Invoicing
- Payment

Findings: Contractors have standardized on a small number of design tools with Autodesk and Trimble tools most commonly used. In the estimating phase, a greater variety of tools are used, with Trimble tools and Excel being the most widely used. The RFQ process is most typically being handled manually or through generic productivity tools (i.e. Excel, Access, etc.). Purchasing, receiving, invoicing and payment are most often handled through the contractor's core ERP solution. However, a significant number of companies (nearly 30%) reported as handling the receiving process manually.

Q: Which software do you use as Design/Modeling solution?

Findings: AutoCad and Revit were the most commonly reported design systems in use at nearly 80% of products reported in use.



Procure to Pay Survey: May 2019.

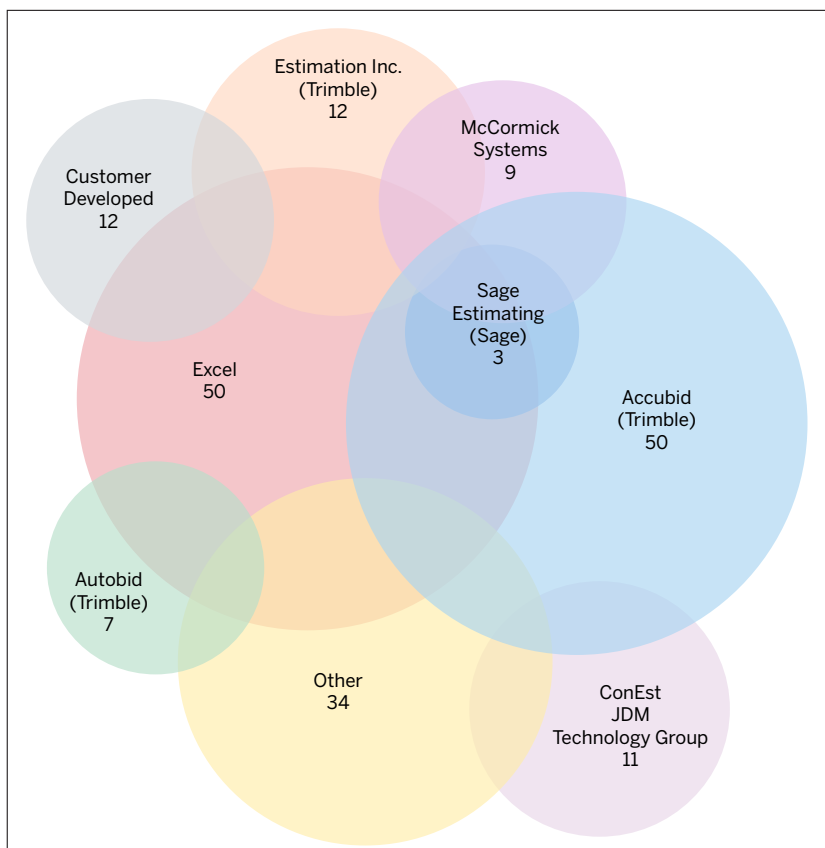


► **Section 2 – Software Solutions Used in Procure-to-Pay Process** (*cont'd*)

Q: Which software do you use as your estimating solution?

Findings: Trimble Accubid and Excel were the most commonly reported estimating solutions in use with 100 of the 193 responses (52%).

Excel was reported in use in conjunction with all estimating packages except ConEst by JDM technology.



Procure to Pay Survey: May 2019.

▶ **Section 2 – Software Solutions Used in Procure-to-Pay Process** (cont'd)

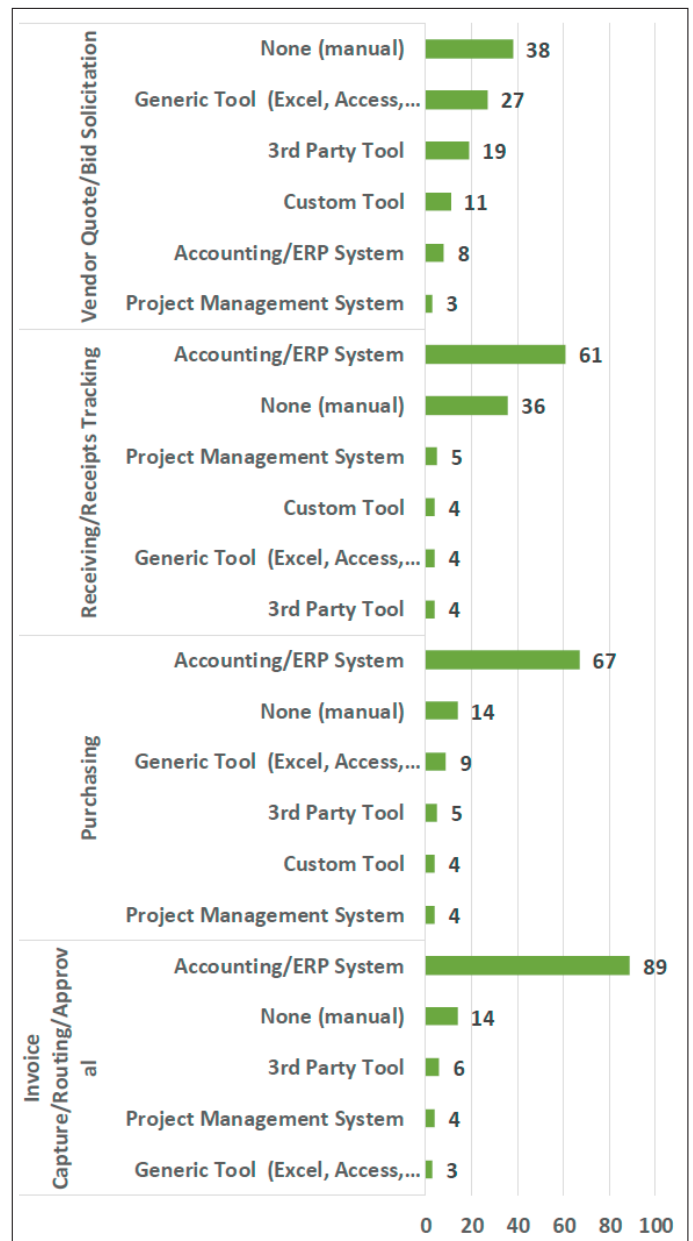
Q: What are the systems used in vendor quote/bid solicitation; purchasing; receiving/receipts tracking; invoice capture/routing/approval?

Findings: Contractors are still using manual or generic tools for the RFQ process. This may be caused by lack of available off-the-shelf tools, or processes that are highly variable making third-party tools difficult to use.

Findings: Accounting/ERP systems are most widely used for receiving. This makes sense due to the direct interactions with purchase orders – also being done with the host ERP. However, a significant number of firms (36) reported manual processes for receiving.

Findings: Accounting/ERP systems are most widely used for purchasing. This makes sense due to the direct interactions with purchase orders, receiving and accounts payable..

Findings: AP invoicing is closely linked to core accounting functions and therefore overwhelmingly handled in the core ERP solution.



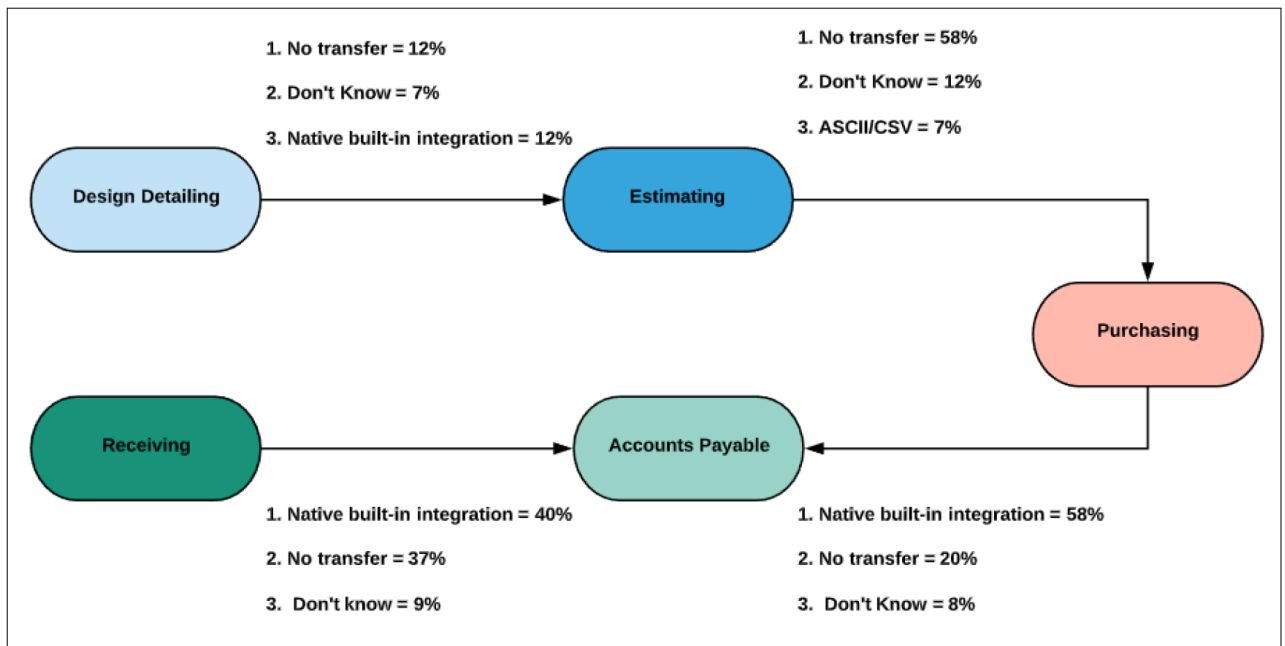
Procure to Pay Survey: May 2019.

Section 3 – Data Integration between Stages of the P2P Process

Findings: In the early phases of the P2P process (design/detailing to estimating to purchasing) systems generally do not communicate.

This is likely due to the following factors:

1. Contractors are using software from different manufacturers and standard integration is limited or not available between systems.
2. Lack of a standard (and accepted) transfer protocol (XML, etc.) between systems.
3. Lack of a standard material (part number) identification scheme adopted by software vendors and suppliers.
4. As the P2P process moves into the purchasing, receiving and invoicing/payment phases, integration between stages increases substantially, mainly due to the fact that contractors are using the core ERP solution for these processes.



Dataflow through key stages of the P2P process.

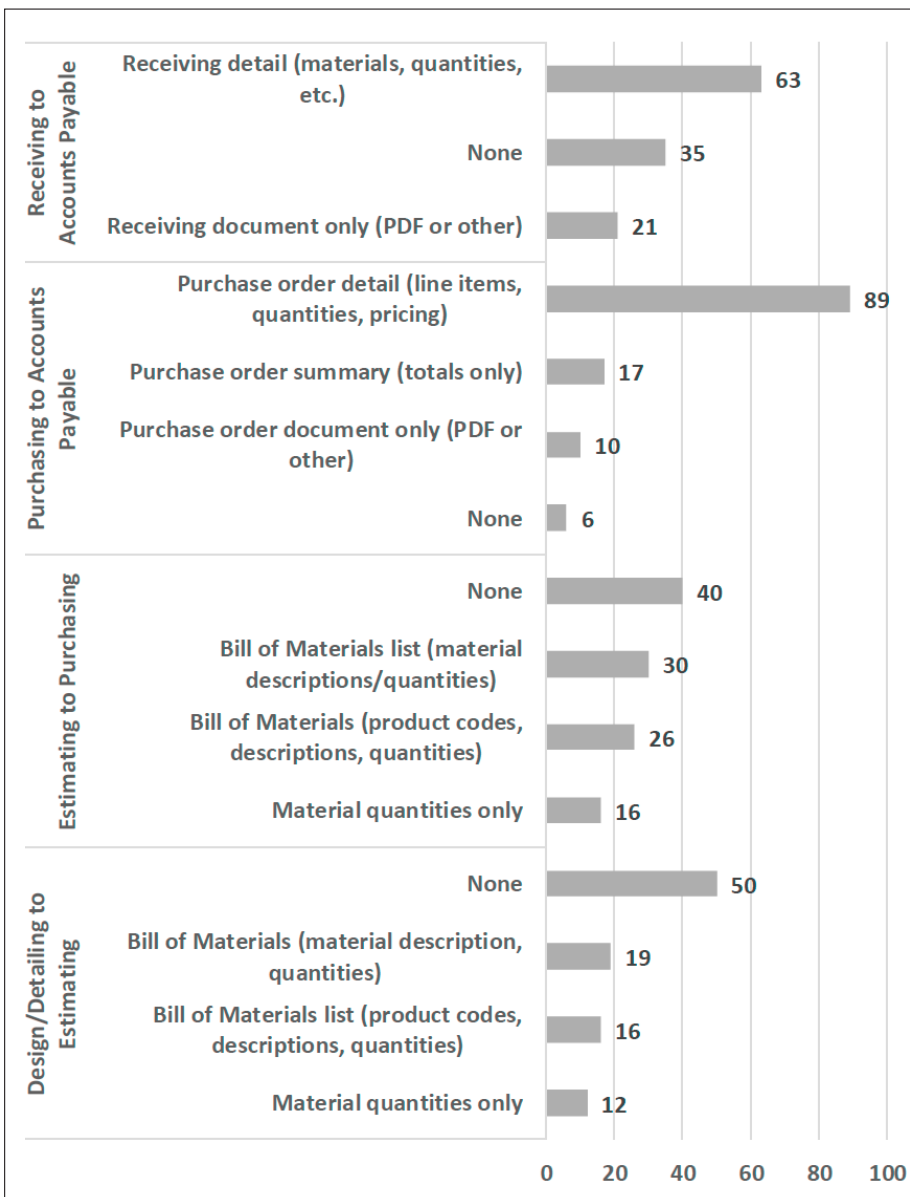
Diagram by Trimble.

▶ Section 4 – Level of Data Flow & Tracking Phases of the P2P Process

Q: What level of detail flows?

Findings: Only 20% of responding companies indicated materials were transferring from estimating to purchasing at the product code level.

Only 12% of responding companies indicated materials were transferring from design/detailing to estimating at the product code level.



Procure to Pay Survey: May 2019.

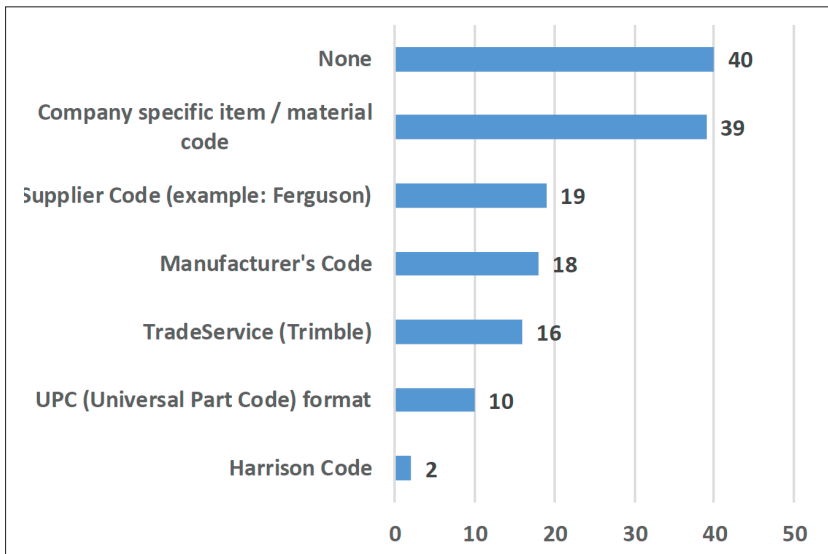


▶ **Section 4 – Level of Data Flow & Tracking Phases of the P2P Process** (*cont'd*)

Q: *Commonly ordered materials are tracked in the following coding formats?*

Findings: *Company-specific product codes were the most widely used.*

Conclusion: This likely inhibits supplier interactions during the purchasing, receiving and invoicing/payment process.



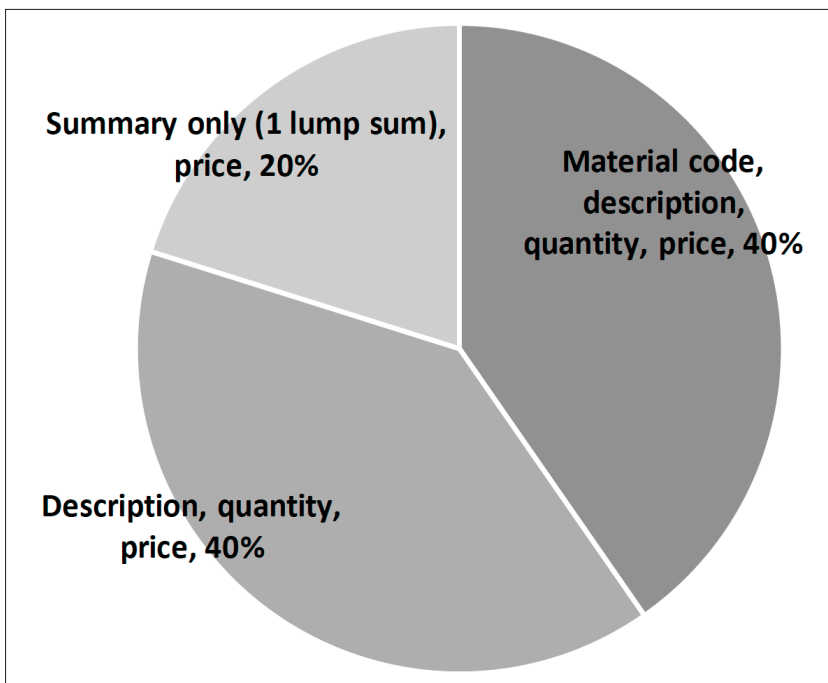
Procure to Pay Survey: May 2019.

▶ **Section 4 – Level of Data Flow & Tracking Phases of the P2P Process (cont'd)**

Q: Purchase orders are tracked at which of the following levels?

Findings: 60% of respondents are tracking POs at no detail (lump sum) or at the description/quantity/price level.

Conclusion: Lack of tracking at the product code level, may contribute to lower levels of EDI with suppliers, as well as reporting deficiencies.



Procure to Pay Survey: May 2019.

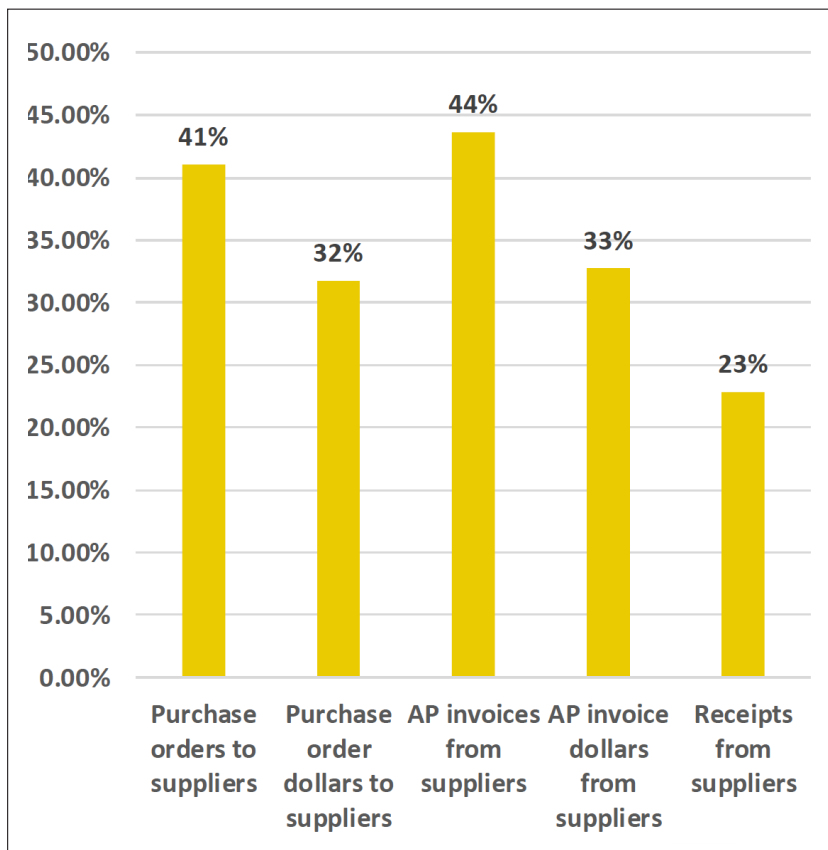


▶ Section 5 – Electronic Data Interchange (EDI) With Suppliers

Summary: MEP contractors are making progress towards more sufficient supply chain interactions, but the majority of transactions and dollars are still manual, paper-based processes. Is lack of integration and information flow during the early phases of the PTP process causing downstream inefficiencies between and contractor and its suppliers?

Q: *Percent of electronically transferred documents in each phase of project?*

Findings: *The majority of P2P transactions and dollars still occur through paper-based transactions.*

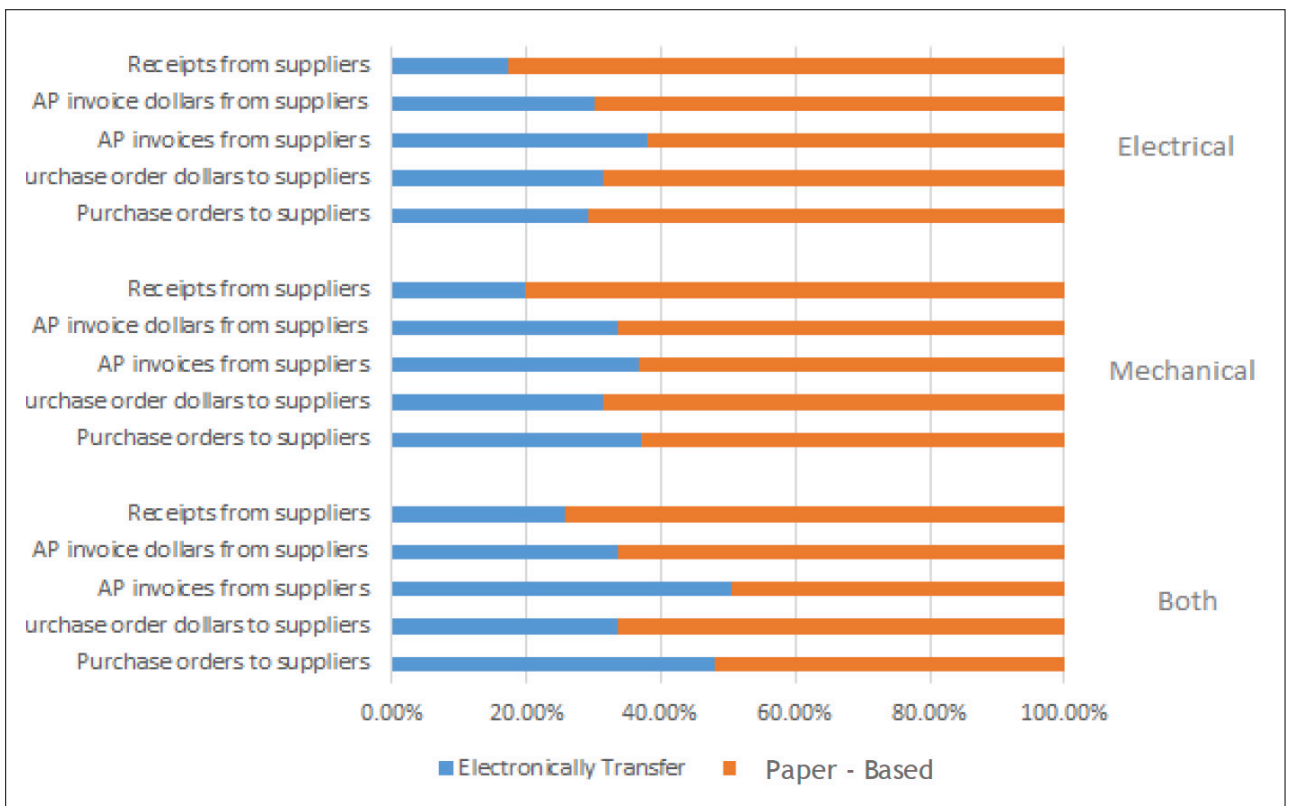


Procure to Pay Survey: May 2019.

▶ **Section 5 – Electronic Data Interchange (EDI) With Suppliers** (*cont'd*)

Q: *Percent of electronically transferred transactions in each phase of project, by document type?*

Findings: *Adoption levels of electronic-based transactions were consistent between mechanical, electrical and those contractors who performed both disciplines.transactions.*



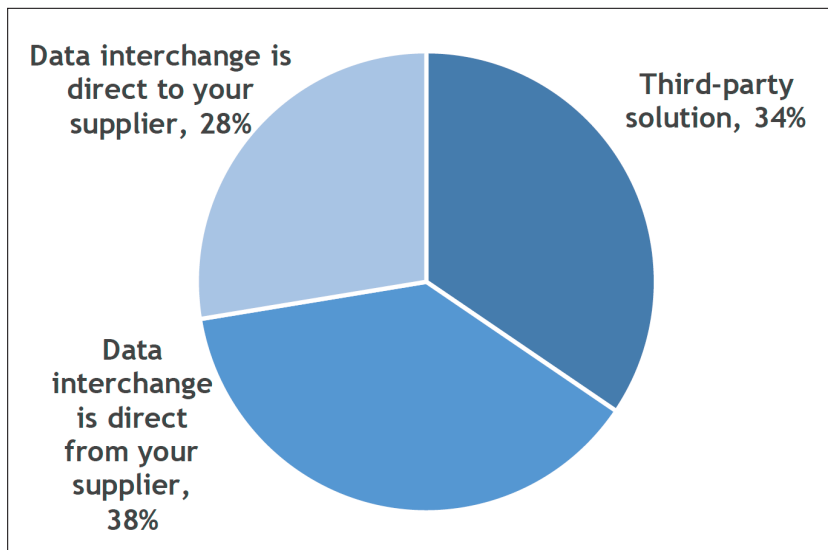
Procure to Pay Survey: May 2019.

▶ Section 6a – Procurement Processes and Performance

Findings: MEP contractors vary widely with regard to enforcement of strict purchasing standards. Autonomy and flexibility provided in the procurement process may be related to the project-centric nature of construction purchasing. Project managers are given wide latitude to make critical purchasing decisions, but they may lack the skills and rigor to optimize purchasing decisions. Contractors view their P2P processes and the various roles supporting the process as adequate but not fully supporting the process.

Q: If Supplier Electronic Data Interchange is active, which applies?

Findings: If EDI is used, 66% of respondents report direct interchange with suppliers. Third-party solutions are actively used to facilitate interchange with suppliers.

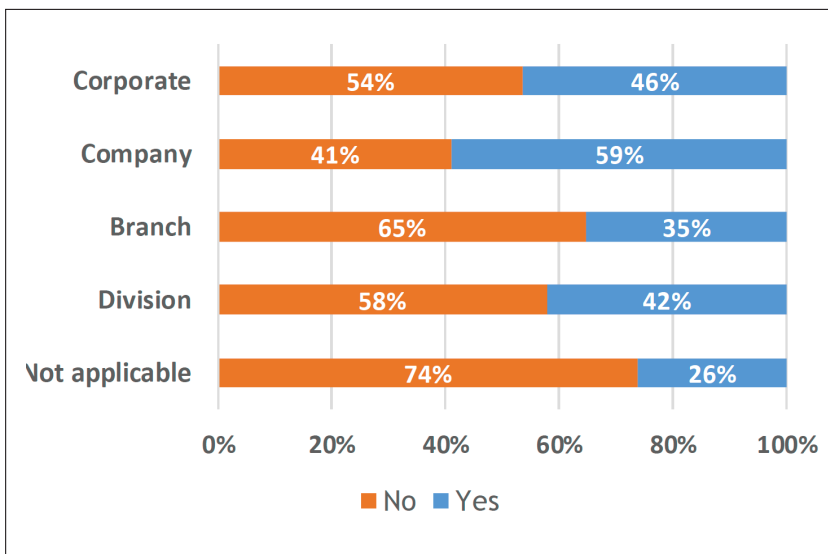


Procure to Pay Survey: May 2019.

▶ **Section 6a – Procurement Processes and Performance** (*continued*)

Q: Does your company have dedicated purchasing personnel at the following levels?

Findings: Organizations with corporate or branch structures were more likely to have dedicated purchasing personnel. This may relate to the complexity and sophistication of the organization.



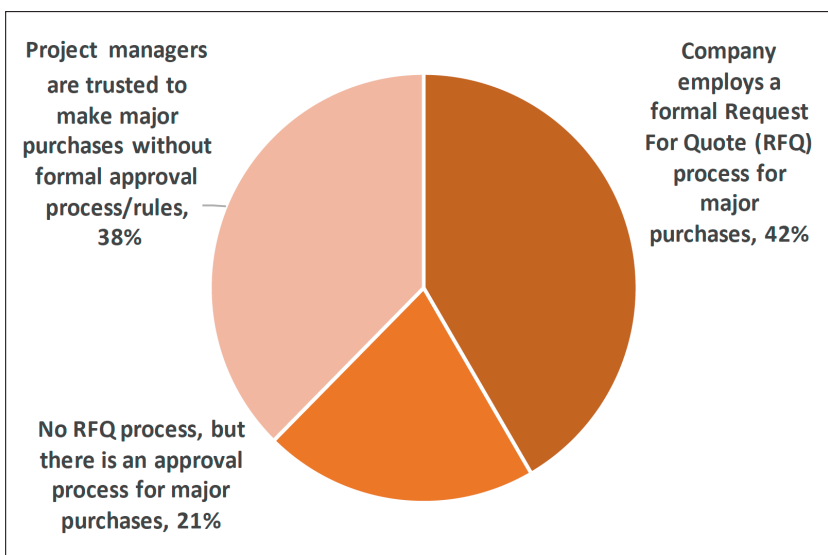
Procure to Pay Survey: May 2019.



► **Section 6a – Procurement Processes and Performance** (*continued*)

Q: Which of the following best describes your handling of major purchases for projects?

Findings: 59% of respondents indicated they were not using a formal RFQ process for major purchases.



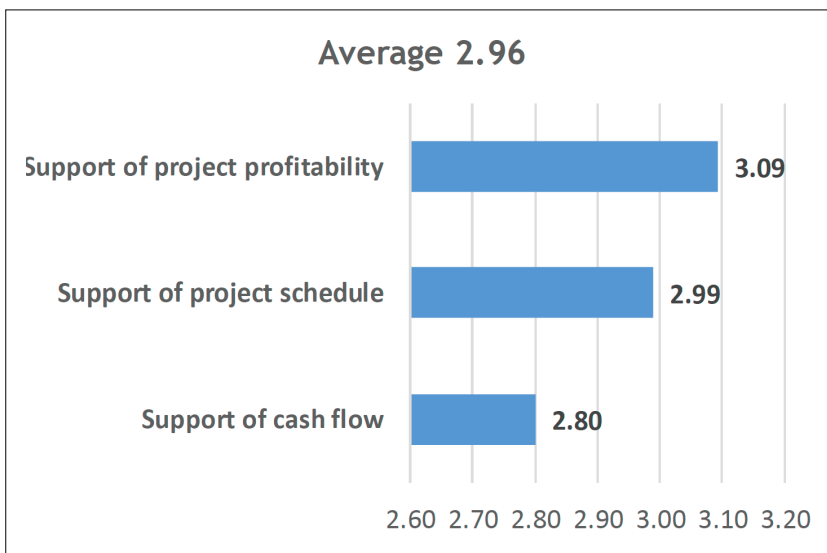
Procure to Pay Survey: May 2019.

▶ Section 6b – Procurement Processes & People – Support of Key Performance Areas

The survey asked contractors to rate their procurement processes & people on a scale of 1-5 in how they support key company performance areas. 1 = Does not support, 3 adequate, and 5 = fully supports.

Q: How would you rate your procurement process in the following performance areas?

Findings: Respondents rated their procurement processes as adequate overall. However, support of cash flow, critical to MEP contractors, was rated as not fully supporting. This indicates a potential area of improvement.

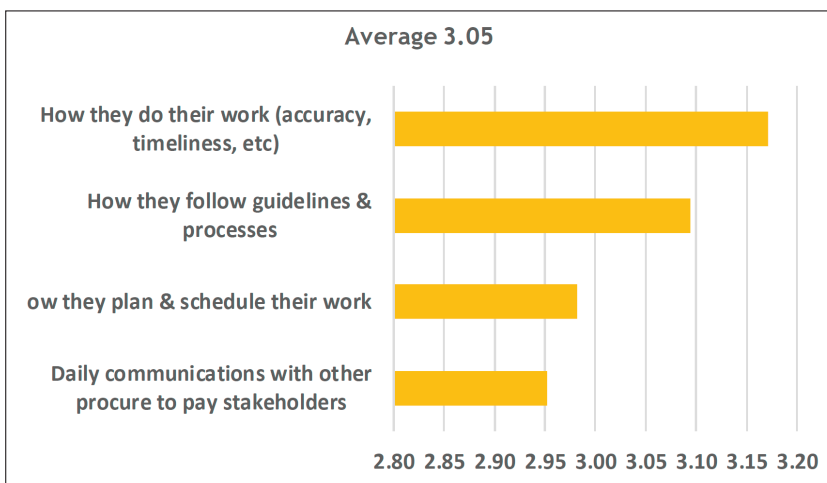


Procure to Pay Survey: May 2019.

▶ **Section 6b – Procurement Processes & People**
– Support of Key Performance Areas (continued)

Q: How would you rate your staff involved in the overall procure to pay process in the following areas?

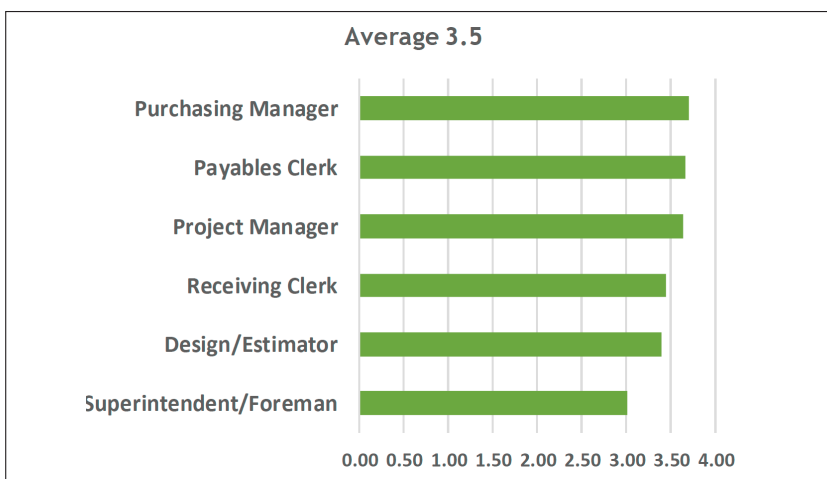
Findings: Respondents rated their staff as “adequate” overall in support of the procurement process. This indicates a potential area of improvement.



Procure to Pay Survey: May 2019.

Q: The following procure to pay stakeholders have access to the data and information they need to effectively perform their tasks?

Findings: Contractors rated information access as 3.5 on a scale of 1-5. This indicates a potential area of improvement.

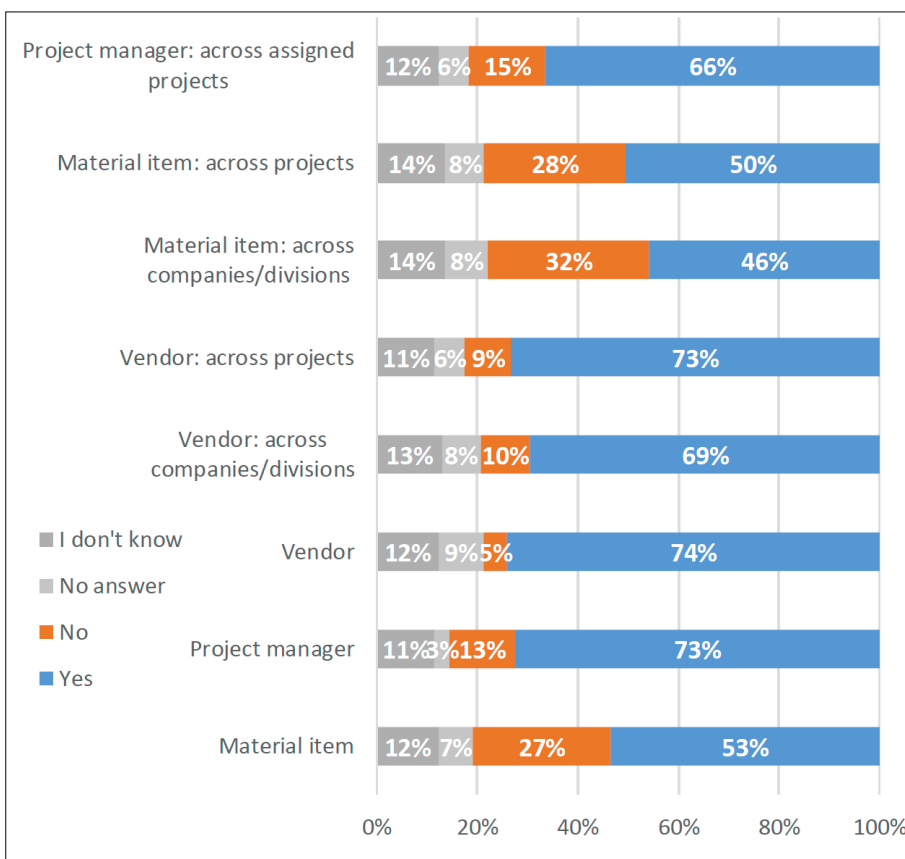


Procure to Pay Survey: May 2019.

▶ Section 7 – Purchasing Data Available for Business Insights

Q: Purchasing data is available at the following levels? (Y/N)

Findings: Respondents reported that purchasing data is available at a variety of levels, but as indicated in the previous question (page 28, “Average 3.5”), there is room for improvement in how the data/systems support the process.



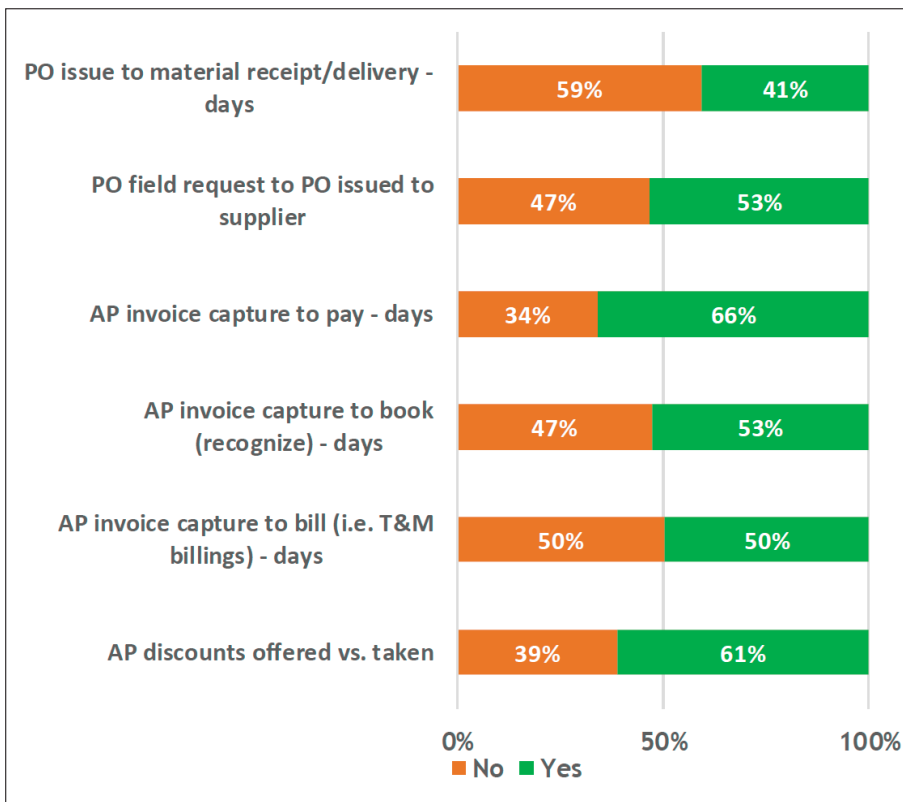
Procure to Pay Survey: May 2019.



▶ **Section 7 – Purchasing Data Available for Business Insights** *(continued)*

Q: *Is the following purchase cycle data tracked? (Y/N)*

Findings: *Roughly 50% of respondents are tracking Key Performance Indicator (KPI) data relative to the P2P process. This may indicate that wider adoption of KPIs (performance metrics) would benefit the industry.*



Procure to Pay Survey: May 2019.



▶ Conclusion

While MEP contractors are actively using technology to manage the procure-to-pay (P2P) process, the survey suggests that software systems and data flow remain highly disconnected (fragmented), with significant manual steps and reentry of data during this complex and multi-faceted process. Integration in The P2P process is further challenged by lack of standards in the areas of EDI between systems, as well as a common material specification. Lack of standards in these areas may likely contribute to the significant construction productivity gap referenced at the beginning of this document.

A Path to Improved Productivity for the MEP Industry

Industry technology leaders, working collaboratively with MEP contractors and suppliers, have the opportunity to further analyze the specific work processes, systems and data flow associated with the P2P process. By taking a higher level “industry view” rather than a “siloed” approach, there is rich opportunity for improvements in P2P process efficiency as well as the quality of data for critical management reporting systems. By improving data flow and quality, the MEP industry may begin to bridge the gap with other industries in terms of overall productivity.



▶ About Viewpoint

Viewpoint, a Trimble Company (NASDAQ: TRMB), enables contractors to better manage their projects, processes and people, using the data gathered to lower risk and improve margins. The ViewpointOne construction management software suite integrates operations across the office, team and field to improve project profitability and enhance productivity. With nearly 8,000 clients, including more than 40 percent of the ENR 400, Viewpoint's innovations are transforming the construction industry by fully integrating operations across financial and HR systems, project management tools and mobile field solutions. For more information, visit: www.viewpoint.com.

About Trimble

Trimble is an industrial technology company transforming the way the world works by delivering solutions that enable our customers to thrive. Core technologies in positioning, modeling, connectivity and data analytics connect the digital and physical worlds to improve productivity, quality, safety, transparency and sustainability. From purpose built products to enterprise lifecycle solutions, Trimble is transforming industries such as agriculture, construction, geospatial and transportation. For more information about Trimble (NASDAQ:TRMB), visit: www.trimble.com.

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