

Removing Paper Obstacles to Operational Excellence in Manufacturing

WHITE PAPER

Sponsored by: OKI Data Americas

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MANUFACTURING INSIGHTS OPINION

Manufacturing firms have made great strides in improving their productivity over the past 10 years. Much of the credit goes to continuous improvement methodologies such as lean and Six Sigma. These initiatives have eliminated wasteful activities, introduced greater consistency, and provided a measure of control. In fact, our research shows that companies with mature continuous improvement programs enjoy faster revenue growth and higher profitability.

However, manufacturing firms still rely on paper-based forms for processing. High levels of paper clutter, manual completion, and duplicate keypunching represent areas of waste that most firms have not addressed. This is particularly true for operational activity — incoming material, production processes, and finished goods shipping. Some information collection has been automated, largely to support transactions relative to a company's enterprise resource planning application, but the majority of information collection is less structured and a great candidate for digital capture technologies.

The central benefit of moving to digital capture in manufacturing lies largely in removing these wasteful paper obstacles to fully realizing the potential of continuous improvement activities. Document management becomes less costly as the storage and retrieval of important reference information becomes more streamlined. And the information itself becomes more complete, accurate, and timely. An additional benefit of the technology is the shift to electronic processes, which is certainly in line with companies' efforts to be more environmentally sustainable.

Manufacturing Insights recommends that manufacturing firms look at technologies such as digital pen-based information capture and document scanning as enablers to capturing these benefits. These technologies are intuitive to use and provide a rapid return on investment. The investments integrate and complement continuous improvement activities.

IN THIS WHITE PAPER

In this white paper, Manufacturing Insights, an IDC company, looks at data capture within the manufacturing operations function. It is our premise that, while manufacturing companies have achieved significant productivity gains through the application of lean principles, there is often too much waste in the recording and storing of paper forms. Manufacturers often cannot eliminate the paper due to regulatory or business policies that require reporting, but the activity is ripe for streamlining.

In the paper, we break the manufacturing operations process into three high-level activities — inbound materials, production operations, and outbound finished goods. These processes are further segmented and analyzed for opportunities to improve paper-based data acquisition. Companies can use this data to benchmark their own activities and determine where to invest in technology to realize benefit.

In this white paper, Manufacturing Insights presents the case for leveraging automated data capture technology and business process within manufacturing operations. We base our opinions and guidance on insights from the ongoing interaction we have with manufacturers, as well as a market survey we conducted specifically in support of this white paper.

Summary of Key Findings

Some of the key findings from our survey of 100 manufacturing companies are as follows:

Finding #1 — Ninety-four percent of manufacturers still use a combination of paper and electronic forms. While no manufacturer reported using only paper forms, 94% reported still using some paper to record and archive information. Paper accounted for more than half (57.5%) of the activity.

Finding #2 — Approximately 31% of forms are still printed centrally or purchased externally. This is a huge problem in production operations, where the movement of materials through the process requires tracking of product structure, quality, cost, and schedules. Paper forms are inefficient, latent in reporting information, and difficult to recall once filed.

Finding #3 — Data acquisition is still immature. Nearly 60% of the input is done manually, either by the person completing the form or by another employee — which incurs avoidable labor costs and leaves room for human error.

Finding #4 — Benefits are well-recognized. The manufacturers in the survey recognized process efficiency/lower costs, better storage/retrieval of information, and higher data accuracy as the top benefits of streamlining paper-based processes.

Finding #5 — Production operations represent the greatest potential. Although both inbound material and outbound finished goods processes were scored high for use of paper forms and benefit potential, production operations was at the top of both measures. Within production operations, manufacturing activity (over quality and maintenance) was the priority.

Summary of Recommendations

Our research shows that the manufacturing industry still relies heavily on paper forms. A combination of pressures for regulatory compliance, improved productivity, and a higher level of quality puts a priority on eliminating waste, and including a rethinking of forms use can support those efforts.

Manufacturing Insights recommends a number of actions to take advantage of the opportunity:

- **Integrate forms automation with lean/Six Sigma efforts.** A study of manufacturers by the London School of Economics demonstrated that the benefits of continuous improvement programs such as lean and Six Sigma can be magnified through the astute use of technology. Modernizing information capture is aligned with eliminating waste, so companies should use the data in the white paper to benchmark their own opportunities for streamlining forms processing.
- **Frame technology selections based on specific needs.** This white paper provides a simple two-by-two figure to classify different types of information acquisition requirements in manufacturing. Nearly two-thirds of paper form activity is related to "fill and file" forms that would benefit from digital pen and scanning technologies.
- **Include all potential benefits in justifying investment.** There are numerous benefits to automation beyond making the processes more efficient. More accurate, complete, and timely data translates to better decision making. Document management costs related to storage and retrieval can be reduced.
- **Monitor benefits realization and create momentum.** Record early gains from automation and promote the results to the rest of the organization. This important ongoing activity will serve to create a culture of continuous review of the use and processing of paper forms.

METHODOLOGY

This research was sponsored by OKI Data Americas and conducted by Manufacturing Insights. The primary research component of the paper consisted of formal surveys with IT directors from 250 firms across the manufacturing, transportation/logistics, and retail industries in North America. To be included in the study, the firms had to have more than 1,000 employees. Each respondent was screened based on involvement with relevant technologies and business processes at his/her firm. Results of the study are presented in aggregate in the figures throughout this paper. Extensive secondary research was also performed by Manufacturing Insights in the course of preparing this study.

Manufacturing Insights feels strongly about the business value of the types of solutions discussed in this analysis. However, this paper is not intended to recommend any specific solution or vendor.

SITUATION OVERVIEW

Lean Companies Outperform Their Peers

Manufacturing Insights maintains a global performance index, an index of over 850 global manufacturing companies that allows us to track performance in the areas of revenue, profitability, and inventory, among others. The companies in the index represent a cross-section of various manufacturing segments (e.g., automotive, aerospace, high tech, chemicals, and consumer packaged goods). We have also identified companies in the index that are well-known for having high levels of maturity in implementing lean and Six Sigma improvement disciplines.

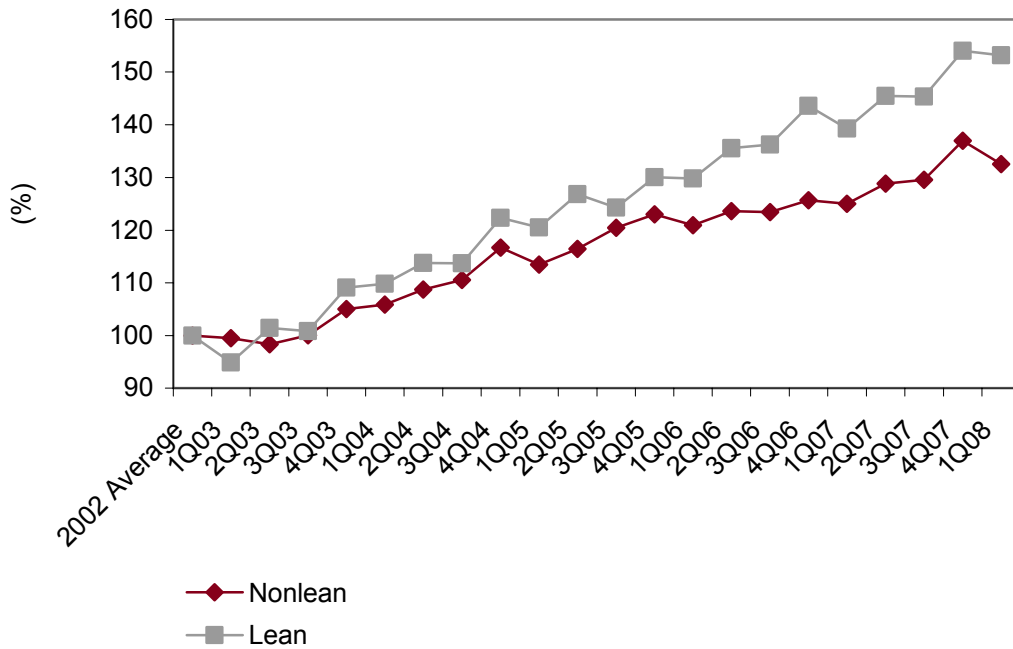
Examining the superior performance of the companies in the lean index provides a compelling business case for adopting these practices. And, since lean objectives are about eliminating waste, the analysis serves as a great backdrop for discussing the elimination of manual forms processing.

Faster Revenue Growth

Revenue growth for the lean index companies is far superior. Using an index base of 100 (based on the average quarterly revenue in 2002), the lean index companies have grown to an index of 153 versus an index of 133 for all other companies in the overall global performance index (see Figure 1). This is a 15% better result over 21 quarters.

FIGURE 1

Worldwide Lean and Nonlean Revenue Index, 1Q03–1Q08



Source: Manufacturing Insights' Global Performance Index, 2008

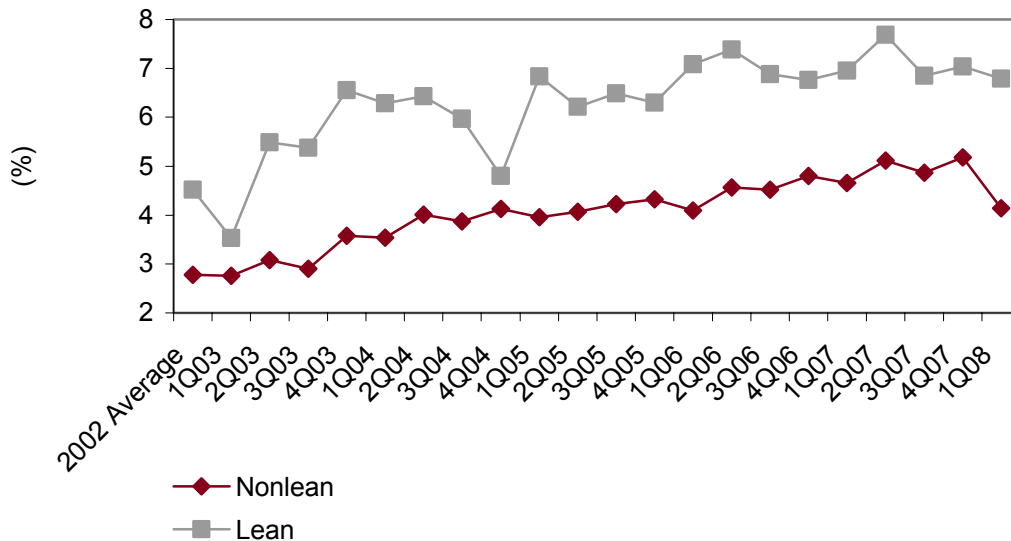
The better record for the lean companies can be attributed to the fact that lean companies operate under a demand-initiated construct and are able to adjust more rapidly to market changes. Balancing manufacturing resources and initiating production rate changes based on demand information is crucial to lean success.

Higher Profit Margins

The most impressive area of performance for lean companies is profitability. Companies in the lean index have established and maintain profit margins that are 2.0–2.5% higher than the profit margins of other manufacturing firms in the index (see Figure 2). This performance translates to more than \$2 million in profit for every \$100 million of revenue.

FIGURE 2

Worldwide Lean and Nonlean Median Net Profit Margins, 1Q03–1Q08



Source: Manufacturing Insights' Global Performance Index, 2008

The principle of waste elimination allows companies with mature lean programs to continuously improve their cost position. The cultural immersion of lean thinking translates to more effective use of raw materials, optimal labor staffing, and streamlined processes.

The Relationship Between Lean and Paper Forms

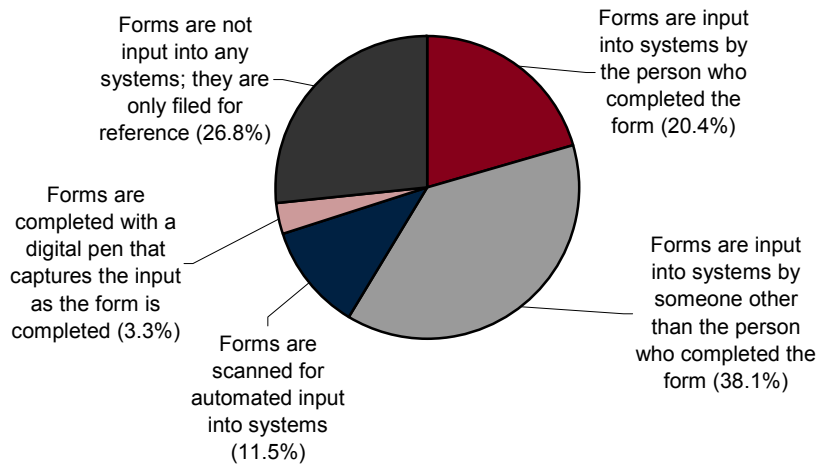
Given the proven success of lean initiatives, it should be no surprise that more than 90% of manufacturing companies are trying to establish some lean/Six Sigma methodologies. Although most companies lack the maturity of those identified in our index, they typically begin with production operations, including inbound material, manufacturing, and outbound shipment of finished goods.

Any activity that does not add value, such as the completion of paperwork, is considered wasteful and a candidate for review and improvement. Given the widespread use of lean, it would be logical to conclude that paper-based forms have been aggressively eliminated. However, survey results showed that, while none of the respondents were using only paper, 94% were using a combination of paper and electronic forms. When respondents were asked for percentages of electronic versus paper forms, their responses showed that 57.5% of processing was done on paper.

Manufacturing Insights also collected information on how companies recorded the information collected on paper forms. The most popular choice (38%) is one that hasn't changed in 30 years — forms are input by someone other than the person who completed the form (see Figure 3). This method may represent the most wasteful across the use of human resources, time, and data quality. Close in terms of wastefulness is no entry of the information at all, which was the case for nearly 27% of the forms at the companies queried. The time is wasted if the forms are never referenced and even more so if paper files must be retrieved to locate the information. Input by the person who completed the form, which means that the person is repeating his/her efforts, was another popular choice (20%).

FIGURE 3

Distribution of Input Methods

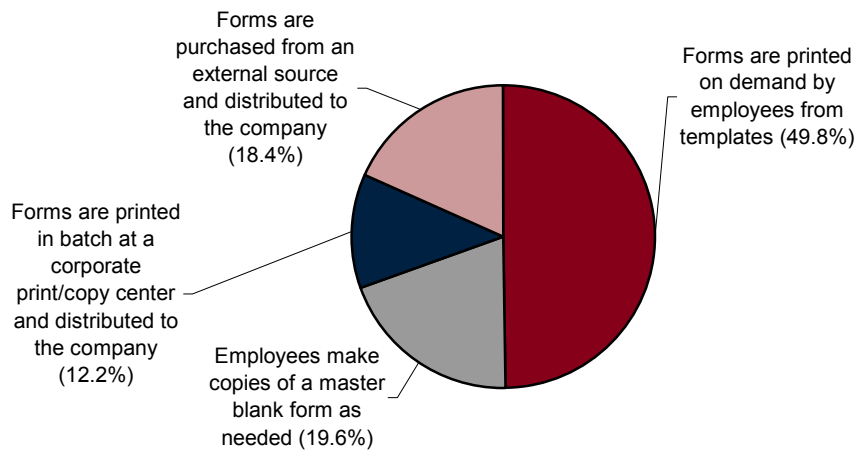


Source: Manufacturing Insights, 2008

Another part of the survey was to investigate how paper forms are produced. Results show that companies are at least becoming more streamlined here, with nearly half the forms printed on demand (see Figure 4). However, approximately 31% of the forms are still either purchased from a third party or printed in a corporate print center.

FIGURE 4

Distribution of Printing Methods



Source: Manufacturing Insights, 2008

Manufacturing Companies See the Benefits of Streamlining Forms Processing

Firms understand that there is a tremendous opportunity to improve business performance by automating the collection of information. Table 1 provides a ranked list of the areas of improvement identified by respondents to the survey (the numbers in the table add to 300 because companies gave their top 3). The ranking provides a good mix of efficiency, administrative costs, and data accuracy.

TABLE 1

Area of Improvement	
Area	% of Respondents
Process efficiency/lower costs	41
Ability to better store/retrieve information	41
Higher accuracy of data	36
Reduced document management costs	33
Authorized signature capture for regulatory compliance	24
Better timeliness of data	24
Elimination of data entry personnel	21
More complete data	18
Higher levels of data security	16
Better inventory management	11
Higher levels of collaboration	10
Higher customer satisfaction	7
Improved quality of products and services	7
Lower training costs	4
Faster cash collection cycles	4
Other	3

Source: Manufacturing Insights, 2008

The two responses that made more than 40% of the respondents' lists were process efficiency and easier document storage and retrieval. Process efficiency shows an appreciation of how improving forms processing links directly with lean efforts, which are also foremost about process efficiency. Storage and retrieval reflects the frustration that results from having to locate information that is kept in unstructured forms or in paper filing systems.

The next tier of responses was above 30% and consisted of higher data accuracy (36%) and reduced document management costs (33%). The first recognizes that current input methods lead to issues around recording information accurately. Document management identifies opportunities to reduce administrative costs.

Responses that had a frequency of between 20% and 30% rounded out the top 7 responses. Timeliness of information relates closely to accuracy as companies recognize that current approaches also carry considerable latency. Like timeliness, signature capture for regulatory compliance made 24% of the rankings. This area scored particularly high in manufacturing, where regulation is a fact of life. At 21%, elimination of data entry personnel is perhaps the most direct benefit available and related to the high level of input by personnel other than the person who completed the forms.

The ranked list represents a good starting point for companies to identify and eliminate areas of waste. Improvements available should be diverse, and investments that enable those improvements will carry a rapid payback.

FUTURE OUTLOOK: PRIORITIZING PROCESSES

The use of paper forms goes across all processes in manufacturing. The research conducted as part of this study sought to identify both specific processes that made substantial use of paper forms and the potential for improvement. On a basic five-point scale, a value above 2.5 on the use of paper represents a significant response and a value below 2.5 on the benefits assessment indicates potential for improvement.

Overall, operational processes scored 2.63 on forms use and 1.96 for potential benefits. Table 2 shows the values for overall operational processes and the major subsets of inbound material, production operations, and outbound finished goods.

TABLE 2

Values for Overall Operational Processes

Process	Manual Forms Usage: >2.5 = Still a Factor	Improvement Opportunity: <2.5 = Significant
Overall operational	2.63	1.96
Inbound material	2.57	2.03
Production operations	2.67	1.99
Outbound finished goods	2.51	2.01

Source: Manufacturing Insights, 2008

All three subprocesses under operations show strong indicators for improvement. Production operations scored the best with both the highest use of paper forms and greatest potential for benefit. Inbound material had a slightly higher use of forms and outbound finished goods a slightly higher benefit potential.

Detailed Subprocesses

Incoming materials processing include processes for buying, receiving, and storing raw materials and components. The results of our survey show that the receiving process has both more use of paper forms and the greatest potential for benefit. Procurement scored slightly higher on paper use than inventory processes, but lower for benefit potential (see Table 3).

TABLE 3

List of Detailed Subprocesses

Process	Manual Forms Usage: >2.5 = Significant	Improvement Opportunity: <2.5 = Significant
Inbound materials		
Procurement	2.43	2.09
Receiving	2.55	1.97
Inventory	2.37	2.01
Production operations		
Manufacturing	2.60	1.99
Quality	2.52	2.01
Maintenance	2.43	2.07
Outbound finished goods		
Picking product for shipment	2.30	2.05
Packing and shipping orders	2.35	2.04

Source: Manufacturing Insights, 2008

Outbound finished goods had the lowest scores for the use of paper forms, although by no means paper free. The evaluation for potential benefit was also lower than other detailed processes. Only procurement had less potential.

The values calculated from the survey results clearly demonstrated that usage of paper forms and potential benefits are highest on the factory floor. Maintenance processes had modest scores, but both manufacturing and quality had high forms usage and strong indicators for improvement. Given that most lean and Six Sigma efforts begin with production and quality, there is a strong synergy between elimination of manual forms processing and continuous improvement efforts.

ESSENTIAL GUIDANCE

Our research shows that the manufacturing industry still relies heavily on paper forms. A combination of pressures for regulatory compliance, improved productivity, and a higher level of quality puts a priority on eliminating waste, and including a rethinking of forms use can support those efforts. Manufacturing Insights recommends a number of actions to take advantage of the opportunity:

- **Integrate forms automation with lean/Six Sigma efforts.** Experienced lean practitioners will talk about "monuments" — activities that represent obstacles to achieving operational excellence. Requiring a resource to stop working on tasks that add value to the product to complete paperwork would be considered a monument. However, given regulatory, customer, and administrative requirements, it is not as simple as just eliminating the activity.

Manufacturing Insights recommends that companies train lean and Six Sigma specialists on mechanisms for streamlining the acquisition of information to minimize the impact of paperwork. These specialists should understand why the forms are necessary and have an understanding of what can be done to minimize the time spent completing the input. Also, document management and information quality benefits from automation should be part of their improvement project justification process.

The detailed process areas from this study should be used to assist in setting priorities for which processes should be addressed first. Companies should benchmark their own use of paper forms and the potential benefits from elimination against the findings in this study. Those with the highest combination of use and potential benefit should be targeted for change.

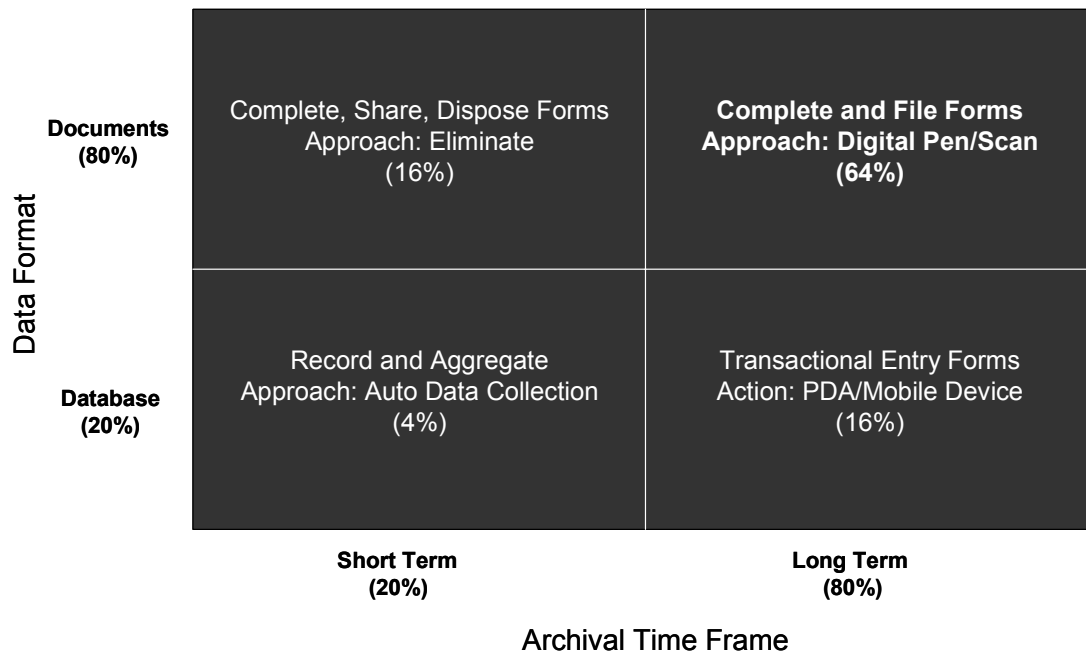
- **Frame technology selections based on specific needs.** A study by the London School of Economics looked at 100 manufacturing firms in the United States and Western Europe to determine the drivers of productivity. The study ranked companies based on two dimensions — the use of advanced management practices (including lean) and the use of technology. Companies that had high usage in both dimensions had 2.5 times better productivity than those that had just high usage of management practices and an order of magnitude (10 times) better than those with just high technology usage.

The conclusion from this study is clear — the effective use of technology magnifies the benefits of lean continuous improvement efforts. However, a single technology may not serve all of a company's needs.

Figure 5 offers a framework for choosing among several technology options.

FIGURE 5

Framework for Addressing Paper Forms with Technology



Source: Manufacturing Insights, 2008

The framework is based on two dimensions. The first makes a distinction between unstructured (document or content centric) versus structured (database or transactional centric). Manufacturing Insights estimates that 80% of operational forms are of the unstructured category. The second dimension relates to how long the information must be stored for future reference, and our estimates indicate that 80% of forms have a long-term (greater than one month) requirement.

Looking at the structured documents, there is specific technology for both short-term and long-term capture. In the short term, the use of barcodes, RFID, and sensors to capture data can be applied. Most of this data is not kept long term. Rather, the data is

continuously aggregated and averages are sent to the transactional systems. Investment in these automated data collection systems can be steep but brings substantial benefits in the area of timeliness, accuracy, and completeness of data. Only about 4% of information acquisition falls into this category.

Long-term structured data represents information that typically must be entered into application software such as enterprise resource planning or manufacturing execution systems. In this case, representing about 16% of the requirement, mobile devices including laptops, PDAs, or smartphones can be used. The input screens for the application software are adapted for these devices and input is made directly into the databases.

Unstructured content represents 80% of the manufacturing firms' mix. For information with a short shelf life, efforts should be made to reduce paper. Even for information that must continue to be reported, the use of low-tech approaches such as erasable whiteboards may be appropriate. In fact, if one visits a factory with an ongoing lean effort, it is likely that liberal application of reusable mediums will be found. This category represents about 16% of the total requirement.

The largest percentage of forms relate to documents that must be kept for a long period of time. Mobile devices could be used here as well, but the cost and ease of use can be very prohibitive. A better alternative would be to deploy a combination of digital pen and form scanning technologies. With a digital plan, forms printed on standard printers (remember half of all forms are printed on demand) are completed with a writing instrument that has optical recognition. Alternatively, forms can be scanned through a multifunction printer for capture.

- **Include all potential benefits in justifying investment.** The biggest opportunity and perhaps the most overlooked is the large number of documents that aren't necessarily tied to a transaction system but must be completed and stored for possible future retrieval. Digital pen and scanning technologies represent reasonable investment costs (compared with laptops or automatic data collection) and can deliver benefits across all three major areas of improvements:
 - **Productivity.** Processes can be streamlined and support cost savings by eliminating double entry and speeding information acquisition.
 - **Accuracy.** The accuracy, timeliness, and completeness of information can be improved, leading to higher-quality business intelligence.

- **Administrative.** Integration with document management systems will lead to lower storage costs and, more important, better retrieval of information.

Manufacturing companies should make sure they capture all of the benefits that are available. Manufacturing Insights believes that, in most cases, the return on investment will exceed corporate hurdle rates and is likely to have a payback period of less than one year. Vendor selection should emphasize experience with the relevant technology and the proven ability to deliver cost-effective, reliable products.

- **Monitor benefits realization and create momentum.** Prioritizing the processes and selecting the appropriate technology will provide some early wins. If possible, start with documents with long archival requirements — there should be a large number of available opportunities. Audit and report on the early projects to generate momentum with management.

Use this success to expand efforts to more operational processes. With the appropriate understanding and integration with lean/Six Sigma leaders, progression toward operational excellence can be accelerated.

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