

A Forrester Total Economic Impact™
Study Commissioned By IBM
May 2019

The Total Economic Impact™ Of IBM® Maximo® MRO Inventory Optimization

Cost Savings And Business Benefits
Enabled By MRO Inventory Optimization

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Executive Summary

For organizations in asset-intensive industries, the effective management of maintenance, repair, and operations (MRO) spare parts inventory plays an important role in driving cost and resource efficiency, minimizing downtime, and ultimately achieving business goals. Many organizations do not have a standardized, data-driven process to optimize the demand for spare parts as operations evolve, and organizations cannot rely on manual processes and enterprise resource planning (ERP) or enterprise asset management (EAM) systems given the number of spare parts that need to be managed (from tens of thousands to millions). These processes often result in excess inventory, added headcount, cost inefficiencies, and stockouts that can lead to costly downtime.

To reduce costs while maintaining or improving uptime and enabling operational efficiencies, organizations must invest in an analytics solution that can provide data-driven recommendations to optimize spare parts inventory. Benefits from MRO optimization solutions include reduction in inventory holdings and costs, reduction in unplanned downtime by reducing stockouts of critical spares, and efficiency across inventory, warehouse, and supply chain teams.

IBM commissioned Forrester Consulting to conduct a Total Economic Impact™ (TEI) study and examine the potential return on investment (ROI) enterprises may realize by deploying IBM® Maximo® MRO Inventory Optimization. The purpose of this study is to provide readers with a framework to evaluate the potential financial impact of investing in this solution on their organizations. To better understand the benefits, costs, and risks associated with this investment, Forrester interviewed several customers with years of experience using MRO Inventory Optimization. MRO Inventory Optimization optimizes MRO inventory levels by analyzing data for patterns and relationships, ensuring the right spare parts are available at the right time, while also maintaining or improving asset uptime.

Key Findings

Quantified benefits. The following risk-adjusted present value (PV) quantified benefits are representative of those experienced by the companies interviewed:

- › **A net inventory reduction of \$60 million over three years, resulting in a three-year present value carrying cost savings of \$9 million.** The organizations reduce inventory levels by optimizing inventory of critical spares and reducing inventory of non-essential and obsolete spares. The organizations achieve an almost 8% overall net decline in inventory value directly attributable to MRO Inventory Optimization and save an average of 20% in carrying costs due to reduced inventory.
- › **A 40% efficiency improvement for inventory analysts and 5% efficiency improvement for warehouse staff.** Inventory analysts are the primary users of MRO Inventory Optimization, and they use functions including criticality analysis, lead-time analysis, and forecasting algorithms to manage spare parts inventory more effectively and help warehouse staff plan and optimize use of warehouse space. These efficiencies free up inventory analysts and warehouse personnel for more important tasks and lead to an avoidance of future hires.

Key Benefits



Inventory optimization over three years:

\$60 million reduction in inventory value
\$9 million saved in carrying costs



Efficiency gained:

40% efficiency for inventory analysts
5% efficiency for warehouse workers



Downtime cost avoided over three years:

Over \$3 million



ROI
149%



Benefits PV
\$13.6 million



NPV
\$8.1 million



Payback
11 months

- › **Over \$3 million in downtime costs avoided across 10 sites over three years due to service-level improvements.** MRO Inventory Optimization improves the service level at sites by ensuring that the right spare parts are in stock in the event of unplanned asset downtime, minimizing possible stockouts and operations downtime. By the beginning of Year 3, an average 2.5% service-level improvement is directly attributable to an MRO Inventory Optimization deployment.

Unquantified benefit. The interviewed organizations experienced the following benefit, which is not quantified for this study:

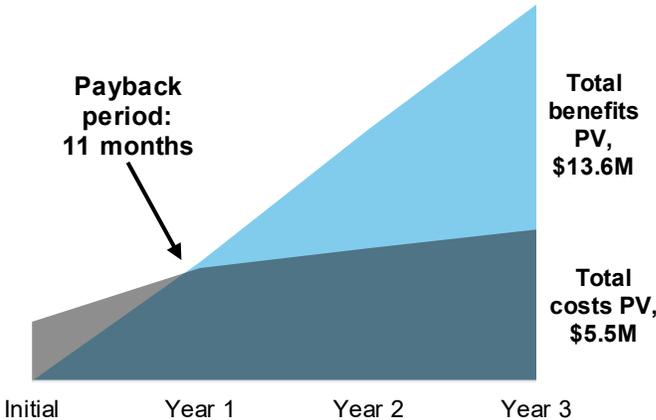
- › **With MRO Inventory Optimization, organizations also reduce procurement costs.** Using MRO Inventory Optimization to order the right amount of spare parts at the right time reduces inventory bloat and improves forecasting, resulting in reductions in the amount of purchase orders and associated purchasing effort needed to maintain spare parts inventory levels for some interviewees.

Costs. The interviewed organizations experienced the following risk-adjusted PV costs:

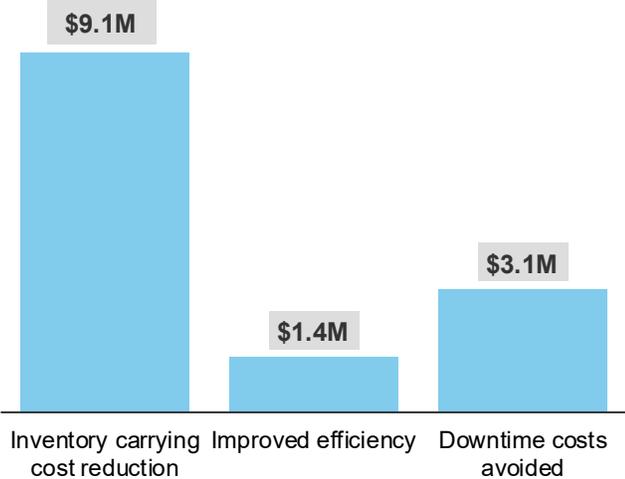
- › **IBM subscription and services costs.** Subscription costs are based on the spare parts inventory managed using the IBM solution. Interviewed organizations also use IBM services to roll out IBM Maximo MRO Inventory Optimization across global sites, as well as to expand or customize functionality once the rollout is complete.
- › **Internal implementation and management time.** Cross-functional teams spend some of their time implementing MRO Inventory Optimization during the rollout period for each site, totaling six FTEs. Management and technical resources combine to account for two total FTEs focused on managing the ongoing use and administration of the solution.
- › **Training and change management time.** Inventory analysts are the primary users of MRO Inventory Optimization and participate in 40 hours of initial training classes and 110 hours of on-the-job training. On an ongoing basis, inventory analysts spend 40 hours per year in refresher training. A cross-functional team also spends a total of 650 hours per year on change management to ensure continuing adoption and use of the solution.

Forrester's interviews with five existing customers and subsequent financial analysis found that an organization with a profile based on these interviewed companies experienced benefits of \$13.6 million over three years versus costs of \$5.5 million, adding up to a net present value (NPV) of \$8.1 million and an ROI of 149%. Given the rollout and adoption assumptions used by Forrester, MRO Inventory Optimization investment pays back quickly, within 11 months.

Financial Summary



Benefits (Three-Year)



The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

TEI Framework and Methodology

From the information provided in the interviews, Forrester has constructed a Total Economic Impact™ (TEI) framework for those organizations considering implementing IBM® Maximo® MRO Inventory Optimization.

The objective of the framework is to identify the cost, benefit, flexibility, and risk factors that affect the investment decision. Forrester took a multistep approach to evaluate the impact that MRO Inventory Optimization can have on an organization:



DUE DILIGENCE

Interviewed IBM stakeholders and Forrester analysts to gather data relative to MRO Inventory Optimization.



CUSTOMER INTERVIEWS

Interviewed five organizations using MRO Inventory Optimization to obtain data with respect to costs, benefits, and risks.



COMPOSITE ORGANIZATION

Designed a composite organization based on characteristics of the interviewed organizations.



FINANCIAL MODEL FRAMEWORK

Constructed a financial model representative of the interviews using the TEI methodology and risk-adjusted the financial model based on issues and concerns of the interviewed organizations.



CASE STUDY

Employed four fundamental elements of TEI in modeling MRO Inventory Optimization's impact: benefits, costs, flexibility, and risks. Given the increasing sophistication that enterprises have regarding ROI analyses related to IT investments, Forrester's TEI methodology serves to provide a complete picture of the total economic impact of purchase decisions. Please see Appendix A for additional information on the TEI methodology.

DISCLOSURES

Readers should be aware of the following:

This study is commissioned by IBM and delivered by Forrester Consulting. It is not meant to be used as a competitive analysis.

Forrester makes no assumptions as to the potential ROI that other organizations will receive. Forrester strongly advises that readers use their own estimates within the framework provided in the report to determine the appropriateness of an investment in IBM® Maximo® MRO Inventory Optimization.

IBM reviewed and provided feedback to Forrester, but Forrester maintains editorial control over the study and its findings and does not accept changes to the study that contradict Forrester's findings or obscure the meaning of the study.

IBM provided the customer names for the interviews but did not participate in the interviews.

The IBM Maximo MRO Inventory Optimization Customer Journey

BEFORE AND AFTER THE MRO INVENTORY OPTIMIZATION INVESTMENT

Interviewed Organizations

For this study, Forrester conducted five interviews with MRO Inventory Optimization customers. Interviewed customers include the following:

INDUSTRY	REGION	INTERVIEWEE	USE OF SOLUTION
Power	Headquartered in North America	Inventory control manager	Approximately four years
Mining and metals	Headquartered in Australia and the United Kingdom	Manager of analysis and improvement for inbound logistics; inventory control manager	Over 15 years
Mining	Headquartered in South Africa	Manager, procurement and materials management	Approximately seven years
Mining and metals	Headquartered in the United States	Senior process leader	Over 10 years
Mining and metals	Headquartered in Australia	Inventory control manager	Approximately six years

Key Challenges

Prior to the investment, the interviewed organizations struggled with the following common challenges:

- › **Asset-intensive industries face unique challenges related to optimizing spare parts.** Complex assets are used in time- and labor-intensive operations around the world, sometimes in harsh environments. Inventory requirements often evolve, so maintaining visibility into availability levels of spare parts based on criticality level and minimizing costs while also maximizing uptime can be extremely challenging.
- › **Prior MRO inventory optimization processes were often ad hoc, relying on ERP systems and manual processes or spreadsheets.** The interviewed organizations did not have standardized processes or solutions to help inventory analysts proactively manage hundreds of thousands to millions of spare parts. Some inventory analysts relied on simple gut feelings to guide inventory management, or they over-ordered items to minimize risk. One interviewee said, “It was very manual, time-consuming, not objective driven or logic driven.” The senior process leader said: “It was very informal. Our ERP system at that time had algorithms built into it. But it was a very informal process between the requester who would use the material and the inventory controller. It was up to their discretion. I can tell you, most of our inventory controllers at that time were more focused on customer service than cash flow or proper investment of funds. They pretty much approved the request for whatever was asked for.”
- › **The overall cost of spare parts was higher than it should have been, and interviewed organizations risked overspending without improving service levels.** Inventory analysts were tasked with finding

“It was very informal. Our ERP system at that time had algorithms built into it. But it was a very informal process between the requester who would use the material and the inventory controller. It was up to their discretion. I can tell you, most of our inventory controllers at that time were more focused on customer service than cash flow or proper investment of funds. They pretty much approved the request for whatever was asked for.”

Senior process leader



the optimal interplay of demand and supply for spare parts without being provided the right tools and processes. This led to spare parts inventory levels that were too low in some areas, negatively impacting maintenance schedules and service levels and leading to unplanned downtime. To avoid costly shortages, inventory analysts increased stocking levels, which were too high, increasing inventory carrying costs and potentially leading to writing off inventory for pennies. The inventory control manager said: “Inventory levels were growing at 8% to 10% year over year prior to when we launched this solution. In the absence of technology, optimizing inventory was a more tedious and time-consuming process.” Another interviewee said: “They would buy things and buy a lot of them without understanding whether they needed them or not. That’s changed over time. Now, we try and help inventory managers understand what the optimal inventory level should be, so we don’t tend to overstock at the start.”

“Inventory levels were growing at 8% to 10% year over year prior to when we launched this solution. In the absence of technology, optimizing inventory was a more tedious and time-consuming process.”

Inventory control manager



Key Results

The interviews with organizations revealed several key results from the MRO Inventory Optimization investment deployment:

- › **Inventory analysts can more easily forecast accurate demand for spare parts, creating efficiencies that enable organizations to avoid hiring additional headcount to keep up with growth.** MRO Inventory Optimization enables analysts to use factors such as criticality, lead time, price, usage patterns, and demand-forecasting algorithms to manage hundreds of thousands to millions of spare parts more effectively. Organizations can implement a centralized process for spare parts optimization that is scalable across all sites and increases overall visibility.
- › **MRO Inventory Optimization enables a net decrease in inventory holdings and delays replenishment costs until parts are needed.** The inventory control manager explained, “By utilizing a process to more consistently monitor inventory, we’ve raised inventory levels to meet growing demand where needed and have lowered inventory levels on items with decreasing demand.”
- › **Optimizing spare parts inventory levels enables organizations to avoid costly stockouts or unplanned downtime, while minimizing safety stock.** MRO Inventory Optimization ensures that the right parts are available in the right place at the right time, reducing the risk of stockouts of critical parts and the resulting operational downtime. Inventory analysts can be more confident that recommended reductions in spares does not negatively impact service-level targets.
- › **Optimizing spare parts inventory value frees up money for organizations to invest in higher ROI projects.** “We are able to use more logic and fact-based information to make better decisions regarding the volume of inventory that sits on the shelf,” said the inventory control manager. “The ability to redeploy funds into higher-return investments for the company — that’s a real benefit.”

“By utilizing a process to more consistently monitor inventory, we’ve raised inventory levels to meet growing demand where needed and have lowered inventory levels on items with decreasing demand.”

Inventory control manager



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Inventory control manager



Composite Organization

Based on the interviews, Forrester constructed a TEI framework, a composite company, and an associated ROI analysis that illustrates the areas financially affected. The composite organization is representative

of the five companies that Forrester interviewed and is used to present the aggregate financial analysis in the next section. The composite organization that Forrester synthesized from the customer interviews has the following characteristics:

Description of composite. The composite organization is a global organization in an asset-intensive industry with approximately \$14 billion in annual revenues and 20,000 employees. The composite organization operates across 10 sites and manages \$700 million in spare parts inventory, consisting of over 2 million total spare parts and 140,000 unique parts. Most of the composite's spare parts inventory is slow moving, with 15% of spare parts inventory classified as fast moving. Prior to the investment in IBM Maximo MRO Inventory Optimization, the organization struggled to manage spare parts inventory through ERP tools and manual processes, resulting in rapidly increasing inventory costs and lower than targeted service levels.

Deployment characteristics. The composite organization deploys IBM Maximo MRO Inventory Optimization as an enterprise solution with centralized management, starting the deployment with five sites live at the beginning of Year 1 and all sites live by the beginning of Year 2. The composite integrates MRO Inventory Optimization with its existing ERP system. The composite has 24 total users, including active users in inventory management roles as well as a few view-only users including warehouse supervisors and maintenance personnel. Inventory analysts spend 50% to 70% of their time using the solution to handle new material requests, review recommendations, and provide accurate information to lines of business. Inventory analysts primarily use the solution on fast-moving inventory and inventory with higher criticality levels. Approximately 15% of the composite's spare parts inventory is fast moving. Eight percent of spare parts fall into the highest criticality levels based on service-level targets, while a majority of spare parts are classified in the middle criticality levels.



Key assumptions

- 2 million+ total spare parts
- \$700 million total inventory value
- 24 MRO Inventory Optimization users

Analysis Of Benefits

QUANTIFIED BENEFIT DATA AS APPLIED TO THE COMPOSITE

Total Benefits

REF.	BENEFIT	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Atr	Inventory carrying cost reduction	\$4,140,000	\$3,960,000	\$2,700,000	\$10,800,000	\$9,064,914
Btr	Improved efficiency	\$345,150	\$545,400	\$836,100	\$1,726,650	\$1,392,691
Ctr	Downtime costs avoided	\$216,000	\$1,296,000	\$2,448,000	\$3,960,000	\$3,106,657
	Total benefits (risk-adjusted)	\$4,701,150	\$5,801,400	\$5,984,100	\$16,486,650	\$13,564,262

Inventory Carrying Cost Reduction

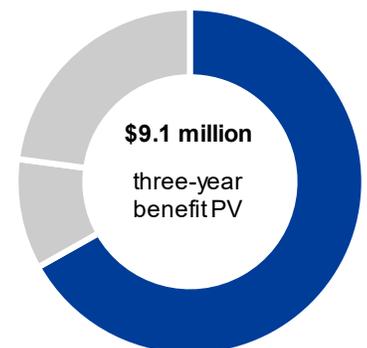
One of the main goals of the IBM investment is to optimize inventory, reducing inventory costs while maintaining or increasing asset service levels. To resolve challenges such as carrying costs of non-essential spares and critical parts out-of-stock, inventory analysts use IBM Maximo MRO Inventory Optimization to identify items by criticality, use special logic for irregular demand or slow-moving spares, and use reporting to determine the optimal quantity of spares.

- › Several interviewed organizations have reduced overall inventory levels. One of the interviewees told us, “When we do it properly and when we’re operating in a period where we’re getting good acceptance by the business, we get both a reduction in stock value and a reduction in purchase orders and invoice transactions as well.” Another interviewee added, “One of the larger benefits is reducing our levels of inventory overall while also increasing our material fill rates.”
- › In addition to year-over-year net reductions in inventory value, some organizations have optimized costs by stabilizing the growth of inventory value while also increasing the number of parts. One interviewee said: “In the past two years, our inventory has remained almost exactly the same, but in the same time, we’re now holding about 2,000 extra lines in that warehouse. We’ve been able to provide more parts to keep the plants running, but we haven’t increased the tied-up working capital.” Another interviewee said: “When we implemented the standard processes, our inventory was growing at about \$5 million a month. But [the solution] has allowed us to control or flatten out overall inventory holding. Although the number of records or SKUs (stock-keeping units) is expanding rapidly, the dollar-value increase to inventory overall has been much smaller.”

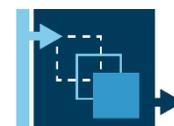
Forrester assumes that:

- › At the beginning of the financial analysis, the composite organization has a total inventory value of \$760 million. Isolating the effects of MRO Inventory Optimization, the organization reduces its spare parts inventory to \$700 million by Year 3, an almost 8% net reduction resulting in \$60 million in inventory reduced over the three years.

The table above shows the total of all benefits across the areas listed below, as well as present values (PVs) discounted at 10%. Over three years, the composite organization expects risk-adjusted total benefits to be a PV of nearly \$13.6 million.



Inventory carrying cost reduction: **67%** of total benefits



\$60 million inventory reduction over three years

- › The main economic benefit of reducing existing inventory levels is to avoid carrying costs associated with that inventory. Forrester assumes an average 20% carrying cost of inventory.
- › In addition, the organization can delay replenishment costs by only purchasing additional spares as needed, contributing to the net reduction in inventory levels. The economic benefit of delaying purchases of new inventory is the time value of money.

Risks could affect the realization of these benefits:

- › Inventory optimization processes may be viewed as a one-time effort versus an ongoing process. To continue achieving value over the years, organizations must proactively manage spares and continuously refine data to ensure accuracy.
- › The quality of recommendations provided by the solution depend on the quality and validation of the data inputted. Legacy data accuracy issues or data transfer issues between systems would reduce benefit value.
- › The ability to optimize inventory levels will depend on the adoption of recommendations by inventory teams and lines of business. For several interviewees, trust in recommendations builds over time with change management efforts.

To account for these risks, Forrester adjusted this benefit downward by 10%, yielding a three-year risk-adjusted total PV of \$9 million.

“One of the larger benefits is reducing our levels of inventory overall while also increasing our material fill rates.”

Inventory control manager



Impact risk is the risk that the business or technology needs of the organization may not be met by the investment, resulting in lower overall total benefits. The greater the uncertainty, the wider the potential range of outcomes for benefit estimates.

Inventory Carrying Cost Reduction: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
A1	Total inventory value, with IBM reductions	Interviews	\$737,000,000	\$715,000,000	\$700,000,000
A2	Total inventory reduction due to IBM	A1 _{PY} -A1	\$23,000,000	\$22,000,000	\$15,000,000
A3	Carrying costs of inventory reduced	A2*20%	\$4,600,000	\$4,400,000	\$3,000,000
At	Inventory carrying cost reduction	A3	\$4,600,000	\$4,400,000	\$3,000,000
	Risk adjustment	↓10%			
A _r	Inventory carrying cost reduction (risk-adjusted)		\$4,140,000	\$3,960,000	\$2,700,000

Improved Efficiency

Compared to previous ad hoc, manual processes, inventory analysts use MRO Inventory Optimization to more easily determine the correct number of spares to stock.

- › Regarding inventory analyst efficiency, one interviewee said: “If we did not have [the solution] and we were growing at the same pace, we probably would need to add manpower to manage the same spare parts. I think the solution has helped to maintain that productivity level.” Another interviewee added, “The solution assists the inventory analyst with making changes because it gives some backup to their gut feel.”
- › Organizations differed in the amount of automation built into their stocking recommendations. While some have no automation, others automatically accept recommendations within a specific threshold.

“It allows the inventory team to be more effective at their job because it gives them more information to consider, and it allows them to make better decisions.”

Senior process leader



Either way, organizations save time, allowing inventory analysts to focus on more critical analyses and higher-dollar recommendations. The senior process leader stated, "It allows the inventory team to be more effective at their job because it gives them more information to consider, and it allows them to make better decisions."

- › Some interviewed organizations have also experienced warehouse management efficiencies. One interviewee said: "It's freed up some time for people in the warehouse to do more of the true warehousing functions. That's a lot of people." Another interviewee added, "In terms of interaction with other areas like the warehouse, we help them with reports on what moves fast and slow and optimizing the layouts in the warehouse."

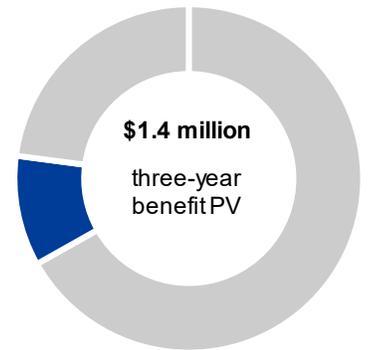
Forrester assumes that:

- › The composite organization initially has 16 inventory analysts, growing to 20 inventory analysts by Year 3. Inventory analysts experience a 40% improvement in efficiency due to MRO Inventory Optimization, enabling the composite to avoid six hires in Years 1 and 2 and seven hires in Year 3. The average annual fully loaded compensation for inventory analysts, including the value of benefits, is \$80,000.
- › Additionally, the organization has approximately 144 warehouse workers in Year 1, up to 180 warehouse workers by Year 3. Warehouse workers experience a 5% efficiency improvement directly attributable to MRO Inventory Optimization, enabling the composite to avoid seven hires in Year 1, up to nine hires by Year 3. The average annual fully loaded compensation for warehouse workers, including the value of benefits, is \$41,000.
- › To incorporate the phased rollout of MRO Inventory Optimization to the organization's sites, the calculation includes an adoption ramp. Forrester assumes 50% of sites are live at the start of Year 1 and that all sites are live by the start of Year 2. By Year 3, all sites have gone up the adoption curve and full efficiency benefits are realized.

Risks could affect the realization of these benefits:

- › The acceptance of recommendations from the solution varies from organization to organization, potentially impacting the amount of efficiency inventory analysts can achieve. Some organizations automatically accept some recommendations while others require all recommendations to be verified. Data quality can also impact the accuracy of recommendations.
- › Some organizations struggle with recurring system downtime, limiting the ability for inventory analysts to access their main solution for inventory management during these downtime periods.

To account for these risks, Forrester adjusted this benefit downward by 10%, yielding a three-year risk-adjusted total PV of \$1.4 million.



Improved efficiency: **10%**
of total benefits



40% improvement in
efficiency for inventory
analysts

Improved Efficiency: Calculation Table

REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
B1	Inventory analyst hires avoided	Interviews	6	6	7
B2	Inventory analyst average annual fully loaded compensation	Assumption	\$80,000	\$80,000	\$80,000
B3	Warehouse hires avoided	Interviews	7	8	9
B4	Warehouse average annual fully loaded compensation	Assumption	\$41,000	\$41,000	\$41,000
B5	Adoption ramp	Assumption	50%	75%	100%
Bt	Improved efficiency	$((B1*B2)+(B3*B4))$ B5	\$383,500	\$606,000	\$929,000
	Risk adjustment	↓10%			
Btr	Improved efficiency (risk-adjusted)		\$345,150	\$545,400	\$836,100

Downtime Costs Avoided

In addition to optimizing inventory costs, organizations use MRO Inventory Optimization to ensure that critical parts are available to minimize downtime without over-purchasing.

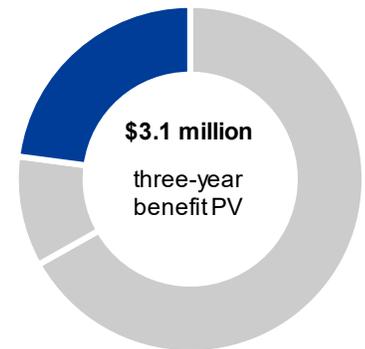
- › Most of the interviewed organizations previously operated at service levels averaging over 90%, so even a small increase in service levels could have a big impact to business operations. One interviewee told us: “I think that for the faster-moving materials, [the solution] makes sure that we are less likely to stockout of those items. I can say that our service level has consistently increased.”
- › The inventory control manager added: “We can monitor stockouts a lot better, and we can understand them better. The impact is that when we do have an event, if we’ve got stock we’re supposed to have, our downtime is minimized. That’s probably the upside of not having stockouts.”

Forrester assumes that:

- › At the start of Year 1, five sites are live, with 10 sites live in Years 2 and 3. The organization has 24x7 operations with two shifts, totaling 4,180 potential uptime hours per year per site.
- › The organization initially begins with average service levels over 90%. With MRO Inventory Optimization, the organization increases its average service levels across live sites by 1% in Year 1, up to 2.5% in Year 3. The total average length of downtime per incident is 60 hours, and the total cost of downtime per incident is \$180,000, enabling the organization to avoid 17 incidents per year by Year 3.¹

Risks could affect the realization of these benefits:

- › Asset downtime can be due to various factors, one of which is having the correct spare part on hand in the event of a failure. It can be difficult for organizations to attribute improvements in service levels to specific initiatives or technologies, and further it can be difficult to measure the total cost impact of downtime, including expediting costs, labor costs to fix the incident, and lost production.



**Downtime costs avoided:
23% of total benefits**

“We can monitor stockouts a lot better, and we can understand them better. The impact is that when we do have an event, if we’ve got stock we’re supposed to have, our downtime is minimized. That’s probably the upside of not having stockouts.”

Inventory control manager



To account for these risks, Forrester adjusted this benefit downward by 20%, yielding a three-year risk-adjusted total PV of \$3.1 million.

Downtime Costs Avoided: Calculation Table					
REF.	METRIC	CALC.	YEAR 1	YEAR 2	YEAR 3
C1	Number of sites using solution	Interviews	5	10	10
C2	Maximum hours of uptime, per site	Assumption	4,160	4,160	4,160
C3	Service-level improvement due to IBM	Interviews	1.00%	1.75%	2.50%
C4	Number of downtime incidents avoided (rounded)	$(C1 * C2 * C3) / 60$	3	12	17
C5	Adoption ramp	Assumption	50%	75%	100%
C6	Cost per incident	Assumption	\$180,000	\$180,000	\$180,000
Ct	Downtime costs avoided	$C4 * C5 * C6$	\$270,000	\$1,620,000	\$3,060,000
	Risk adjustment	↓20%			
Ctr	Downtime costs avoided (risk-adjusted)		\$216,000	\$1,296,000	\$2,448,000

Unquantified Benefits

In addition to the quantified benefits above, interviewees experienced other areas of benefit that could not be quantified. For example:

- **Several interviewees noted that a result of the MRO Inventory Optimization investment is a potential reduction in procurement costs.** By optimizing inventory levels and reducing inventory bloat, some organizations find a corresponding reduction in the amount of purchasing effort required to manage spare parts inventory. An interviewed manager explained, “If we did not have the IBM EOQs (economic order quantities), we might actually end up churning out a greater number of purchase orders (POs), which means that we would need additional purchasing resources.”

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Manager of analysis and improvement for inbound logistics



Flexibility

The value of flexibility is clearly unique to each customer, and the measure of its value varies from organization to organization. There are multiple scenarios in which a customer might choose to implement MRO Inventory Optimization and later realize additional uses and business opportunities, including the following:

- **Some interviewees use spare parts inventory cost savings to fund higher-return investments in the company.** MRO Inventory Optimization leads to considerable inventory cost reductions for the interviewed organizations. Some organizations have been able to repurpose those funds to invest in higher-ROI projects at their organizations.
- **Some interviewees use MRO Inventory Optimization to address shortcomings of other enterprise systems.** One interviewee said: “We utilize an ERP system that is extremely rigid. We pull data from the ERP system and utilize that information for inventory optimization

Flexibility, as defined by TEI, represents an investment in additional capacity or capability that could be turned into business benefit for a future additional investment. This provides an organization with the “right” or the ability to engage in future initiatives but not the obligation to do so.

and to give us a better understanding and more control of that material. We utilize offsite procurement for one of our regional operations, which has five purchasing offices that operate in different countries. Materials are coming from everywhere. Through [the IBM solution], we're able to identify the port of origin where [our ERP] doesn't show us that information directly. We're able to weave that data together through IBM, and it gives us visibility into the real in-transit time. We can separate the suppliers' lead time from our own internal lead time and then apply accepted rules for what the in-transit time can be. So, higher-usage materials get prioritized in the containerization process from the port."

Flexibility would also be quantified when evaluated as part of a specific project (described in more detail in Appendix A).

Analysis Of Costs

QUANTIFIED COST DATA AS APPLIED TO THE COMPOSITE

Total Costs							
REF.	COST	INITIAL	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Dtr	License and services	\$1,365,000	\$1,260,000	\$525,000	\$525,000	\$3,675,000	\$3,338,779
Etr	Internal implementation and management	\$690,000	\$805,000	\$230,000	\$230,000	\$1,955,000	\$1,784,703
Ftr	Training and change management	\$54,720	\$120,432	\$104,472	\$108,120	\$387,744	\$331,776
Total costs (risk-adjusted)		\$2,109,720	\$2,185,432	\$859,472	\$863,120	\$6,017,744	\$5,455,258

License And Services

IBM Maximo MRO Inventory Optimization is a cloud-based solution with annual subscription pricing. Interviewees described the solution as “modular,” with different pieces of functionality available to purchase. In addition, interviewees leverage IBM services to aide with implementation and deployment of the solution as well as ongoing support and feature customizations.

Forrester assumes that:

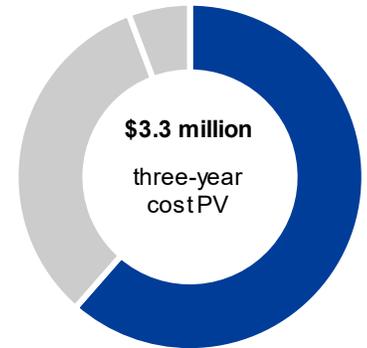
- › The composite organization pays annual subscription costs based on the spare parts inventory managed by MRO Inventory Optimization. Half of sites are live by the start of Year 1, and all sites are live by the start of Year 2. Forrester made a simplifying assumption based on the interviews on the approximate current license cost for the composite organization, though exact costs will vary based on each organization’s deployment.
- › The composite uses IBM services to assist with implementation across all sites, spending more on the first site and less for each additional site. In Years 2 and 3, the organization incurs costs for additional functionality and customizations.

Risks could affect the magnitude of this cost:

- › Subscription costs are variable based on the number and type of spare parts inventory, volume discounts, and other vendor discounts.
- › Implementation costs will depend on the maturity of prior tools and processes around inventory management as well as the complexity of the spare parts environment. Some organizations may not have the expertise in-house to design an optimal implementation and may require more support from IBM than others.

To account for these risks, Forrester adjusted this cost upward by 5%, yielding a three-year risk-adjusted total PV of \$3.3 million.

The table above shows the total of all costs across the areas listed below, as well as present values (PVs) discounted at 10%. Over three years, the composite organization expects risk-adjusted total costs to be a PV of about \$5.5 million.



**License and services:
61% of total costs**

Implementation risk is the risk that a proposed investment may deviate from the original or expected requirements, resulting in higher costs than anticipated. The greater the uncertainty, the wider the potential range of outcomes for cost estimates.

License And Services: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
Dt	License and services	Assumption	\$1,300,000	\$1,200,000	\$500,000	\$500,000
	Risk adjustment	↑5%				
Dtr	License and services (risk-adjusted)		\$1,365,000	\$1,260,000	\$525,000	\$525,000

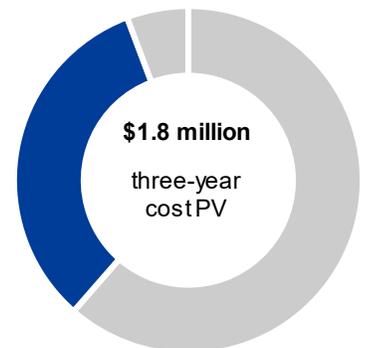
Internal Implementation And Management

In addition to IBM services support, organizations also rely on internal expertise for the implementation and ongoing management of MRO Inventory Optimization. Typically, the first implementation takes approximately three to six months, with additional implementations completed faster. Implementation steps involve planning, data validation, design workshops, configuration and testing, and go-live support. Interviewed organizations integrated MRO Inventory Optimization with existing ERP or EAM tools to understand spare parts movement, establish stocking strategies and demand forecasting, and optimize stocking levels.

- › Internal resources supporting the implementation effort included the project sponsor, project manager, functional subject management experts, IT staff, future users, and business units. For some organizations, this included up to 14 team members, though the implementation effort was not a full-time job. Business units were involved to help determine criticality levels of spare parts. One interviewee explained, “We worked collaboratively with operations personnel to review existing critical codes. It was beneficial to adopt a more stratified method to assign criticality in order to accurately assess the items that can negatively disrupt operations.”
- › Interviewed organizations use MRO Inventory Optimization as a standardized enterprise solution. The senior process leader said, “I believe the key value proposition for this solution is allowing the business to establish a consistent way of transacting or having a standard management expectation of what we want.”
- › Once the sites are all live, management and technical resources handle ongoing management of the solution, including managing users, technical support, and additional customizations or functionality.

Forrester assumes that:

- › For the initial site, the composite spends four months on implementation and deployment, with each additional site requiring two months of effort. A cross-role team is involved in the implementation effort, spending part of its time over the implementation period. This totals to an average of six FTEs’ worth of time over the implementation months. The cross-role average annual fully loaded compensation, including the value of benefits, is \$100,000.
- › On an ongoing basis, management and subject matter experts (SMEs) are required to manage users, add functionality, and resolve functional and technical issues. This totals two FTEs at an average annual fully loaded compensation, including the value of benefits, of \$100,000.



Internal implementation and management: **33%** of total costs

“I believe the key value proposition for this solution is allowing the business to establish a consistent way of transacting or having a standard management expectation of what we want.”

Senior process leader



Risks could affect the magnitude of this cost:

- › Implementation costs will depend on the maturity of prior tools and processes around inventory management as well as the complexity of the spare parts environment. Some organizations may not have the expertise in-house to design an optimal implementation and may require more support from IBM than others. Other interviewees had to invest additional time in redesigning the implementation due to insufficient support from their professional services partners.
- › Some interviewees struggled with technical issues and solution downtime that required additional effort to manage and resolve.

To account for these risks, Forrester adjusted this cost upward by 15%, yielding a three-year risk-adjusted total PV of \$1.8 million.



Four months
Initial site implementation and deployment time

Two months
Remaining site implementation and deployment time

Internal Implementation And Management: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
E1	Number of implementation/rollout months	Interviews	12	10		
E2	Number of internal FTEs involved in implementation	Interviews	6	6		
E3	Average annual fully loaded compensation, implementation team	Assumption	\$100,000	\$100,000		
E4	Ongoing management and administration FTEs	Interviews		2	2	2
E5	Average annual fully loaded compensation, management	Assumption		\$100,000	\$100,000	\$100,000
Et	Internal implementation and management	$((E1/12)*E2*E3) + (E4*E5)$	\$600,000	\$700,000	\$200,000	\$200,000
	Risk adjustment	↑15%				
Etr	Internal implementation and management (risk-adjusted)		\$690,000	\$805,000	\$230,000	\$230,000

Training And Change Management

Training and change management efforts were variable across the interviewees and ranged from simple solution training for active users to a larger shift to inventory optimization processes as a new ongoing way of managing inventory. To give a sense of the variability across interviewees, here are some descriptions of training efforts:

- › “I think it took about six months to get a good understanding of the supply chain and the systems associated with it, which are necessary to use [the solution] effectively.”
- › “We’ve used training for the inventory analyst team, so they can get up to speed.”
- › “For the inventory team, it initially took longer to get up and running because it’s a brand-new solution, and no one had used it before. I think it’s a three-day training course, but possibly up to a week. For new hires, training is an ongoing process, but I would say the initial training would probably be half a day to a day so they could

understand the basics. After that, as the employee starts a new process or a new task, we train them in that.”

In addition, interviewees underwent change management efforts to support adoption of the solution and encourage collaboration across key teams:

- › “The perception in the business was that this was a solution that took inventory away. From the business perspective, there was limited understanding that it was an optimization solution.”
- › “Our customer in all of this is the maintenance team that has to fix the plant and keep things operating. You will often hear if maintenance doesn’t support these recommendations, it’s [the solution’s] fault; they reduced the stock holdings and then we cannot keep the plant running. So it’s an ongoing challenge of defusing and defending that division.”
- › “The relationship between maintenance and inventory control, historically, was very contentious. As we built consistency and structure into our inventory strategy, we took away the ability for the end customer to just have whatever made them feel comfortable. That created a lot of tension. The more we trained the inventory controllers on the value proposition and how to utilize the solution, they felt more comfortable and confident in what they were recommending to the end user.”

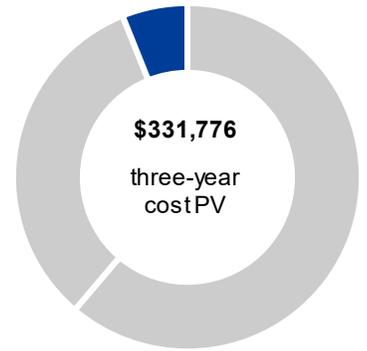
Forrester assumes that:

- › New inventory analysts spend approximately 40 hours in upfront, official training and an additional 110 hours in on-the-job training. There is a 10% growth rate and 15% average turnover rate for inventory analysts. On an ongoing basis, inventory analysts spend 40 hours per year on refresher training. The average hourly fully loaded compensation for inventory analysts, including the value of benefits, is \$38.
- › The composite organization also establishes a cross-functional group to participate in ongoing change management meetings to ensure that objectives are aligned and recommendations are understood and agreed upon. Across the team, 650 total hours per year are spent. The average hourly fully loaded compensation for this team, including the value of benefits, is \$48.

Risks could affect the magnitude of this cost:

- › The initial expertise of users and inventory process maturity will affect the amount of training needed and the amount of change management necessary to encourage adoption.

To account for these risks, Forrester adjusted this cost upward by 20%, yielding a three-year risk-adjusted total PV of \$331,776.



Training and change management: 6% of total costs



150 total hours
for new hire training, 40
official and 110 on the
job
40 hours per year
for ongoing training

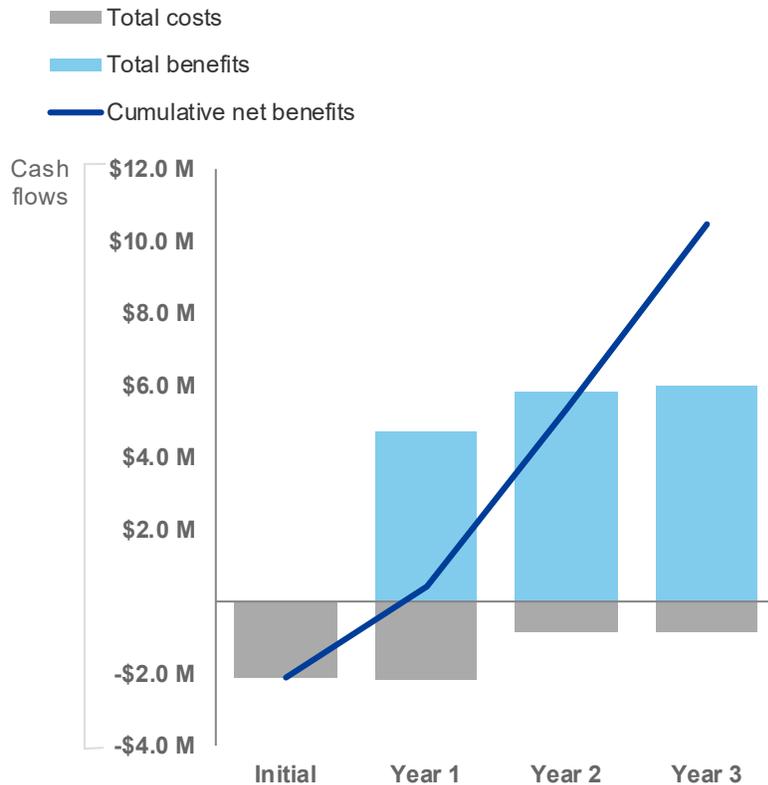
Training And Change Management: Calculation Table

REF.	METRIC	CALC.	INITIAL	YEAR 1	YEAR 2	YEAR 3
F1	Number of new inventory analysts trained	Interviews	8	10	5	5
F2	Total number of inventory analysts using solution	Interviews		8	18	20
F3	New hire official training hours	Interviews	40	40	40	40
F4	New hire on-the-job training hours	Interviews	110	110	110	110
F5	Ongoing training hours	Interviews		40	40	40
F6	Hourly fully loaded compensation, inventory analyst (rounded)	$\$80,000/2,080$	\$38	\$38	\$38	\$38
F7	Total training cost	$((F1*(F3+F4))+(F2*F5))*F6$	\$45,600	\$69,160	\$55,860	\$58,900
F8	Change management hours	Interviews		650	650	650
F9	Average hourly fully loaded compensation, change management team (rounded)	$\$100,000/2,080$		\$48	\$48	\$48
F10	Change management cost	$F8*F9$	\$0	\$31,200	\$31,200	\$31,200
Ft	Training and change management	$F7+F10$	\$45,600	\$100,360	\$87,060	\$90,100
	Risk adjustment	↑20%				
Ftr	Training and change management (risk-adjusted)		\$54,720	\$120,432	\$104,472	\$108,120

Financial Summary

CONSOLIDATED THREE-YEAR RISK-ADJUSTED METRICS

Cash Flow Chart (Risk-Adjusted)



The financial results calculated in the Benefits and Costs sections can be used to determine the ROI, NPV, and payback period for the composite organization's investment. Forrester assumes a yearly discount rate of 10% for this analysis.



These risk-adjusted ROI, NPV, and payback period values are determined by applying risk-adjustment factors to the unadjusted results in each Benefit and Cost section.

Cash Flow Table (Risk-Adjusted)

	INITIAL	YEAR 1	YEAR 2	YEAR 3	TOTAL	PRESENT VALUE
Total costs	(\$2,109,720)	(\$2,185,432)	(\$859,472)	(\$863,120)	(\$6,017,744)	(\$5,455,258)
Total benefits	\$0	\$4,701,150	\$5,801,400	\$5,984,100	\$16,486,650	\$13,564,262
Net benefits	(\$2,109,720)	\$2,515,718	\$4,941,928	\$5,120,980	\$10,468,906	\$8,109,004
ROI						149%
Payback period						11 months

IBM® Maximo® MRO Inventory Optimization: Overview

The following information is provided by IBM. Forrester has not validated any claims and does not endorse IBM or its offerings.

IBM® Maximo® MRO Inventory Optimization is a software-as-a-service-based (SaaS-based) software platform specifically designed for the distinct challenges of MRO asset-intensive environments, such as those found in the mining, oil and gas, chemical, utilities, and manufacturing industries. MRO Inventory Optimization provides users with an accurate, detailed picture of their MRO inventory performance and with powerful capabilities that improve margins, increase service levels, and minimize unplanned downtime.

The solution leverages industry-leading and proprietary algorithms to arrive at the “best-fit” forecasting method for customers and utilizes industry-specific analytics to drive reductions in MRO inventory, spare parts returns, supplier lead times, and other supply chain costs to better balance cost and risk. The solution can be implemented in a matter of months, not years — leading to rapid time-to-value and return on investment.

Some key features of MRO Inventory Optimization include:

- Service-level analysis — Increase service levels by ensuring the right parts are available at the right time.
- Inventory optimization — Align safety stock with business impact using an automated, analytics-based approach.
- Criticality analysis — Segment your inventory by criticality and business impact of MRO spares and materials.
- Lead-time analysis — Determine more accurate lead times beyond supplier-provided information alone to reduce downtime.
- Demand forecasting — Minimize risk of overstocking consumables or stocking out of critical spares.
- What-if analysis — Test different scenarios and find your business’ “sweet spots.”

MRO Inventory Optimization is supported by IBM Services, which provides a full range of professional services to help customers achieve maximum value from the solution. Such services include needs and opportunity analyses, pilot projects, software implementation, technical and functional consulting, business improvement consulting, training, project management, technical support, mentoring, and content cleansing.

Appendix A: Total Economic Impact

Total Economic Impact is a methodology developed by Forrester Research that enhances a company's technology decision-making processes and assists vendors in communicating the value proposition of their products and services to clients. The TEI methodology helps companies demonstrate, justify, and realize the tangible value of IT initiatives to both senior management and other key business stakeholders.

Total Economic Impact Approach



Benefits represent the value delivered to the business by the product. The TEI methodology places equal weight on the measure of benefits and the measure of costs, allowing for a full examination of the effect of the technology on the entire organization.



Costs consider all expenses necessary to deliver the proposed value, or benefits, of the product. The cost category within TEI captures incremental costs over the existing environment for ongoing costs associated with the solution.



Flexibility represents the strategic value that can be obtained for some future additional investment building on top of the initial investment already made. Having the ability to capture that benefit has a PV that can be estimated.



Risks measure the uncertainty of benefit and cost estimates given: 1) the likelihood that estimates will meet original projections and 2) the likelihood that estimates will be tracked over time. TEI risk factors are based on "triangular distribution."

The initial investment column contains costs incurred at "time 0" or at the beginning of Year 1 that are not discounted. All other cash flows are discounted using the discount rate at the end of the year. PV calculations are calculated for each total cost and benefit estimate. NPV calculations in the summary tables are the sum of the initial investment and the discounted cash flows in each year. Sums and present value calculations of the Total Benefits, Total Costs, and Cash Flow tables may not exactly add up, as some rounding may occur.



Present value (PV)

The present or current value of (discounted) cost and benefit estimates given at an interest rate (the discount rate). The PV of costs and benefits feed into the total NPV of cash flows.



Net present value (NPV)

The present or current value of (discounted) future net cash flows given an interest rate (the discount rate). A positive project NPV normally indicates that the investment should be made, unless other projects have higher NPVs.



Return on investment (ROI)

A project's expected return in percentage terms. ROI is calculated by dividing net benefits (benefits less costs) by costs.



Discount rate

The interest rate used in cash flow analysis to take into account the time value of money. Organizations typically use discount rates between 8% and 16%.



Payback period

The breakeven point for an investment. This is the point in time at which net benefits (benefits minus costs) equal initial investment or cost.

Appendix B: Endnotes

¹ Source: “How-To: Combat Unplanned Equipment Downtime,” Mining Global, August 26, 2014 (<https://www.miningglobal.com/machinery/how-combat-unplanned-equipment-downtime>).