Asset Information Management (AIM)
Part I – The Case for Developing an AIM Strategy

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The Cost of Poor Asset Information Can Be Staggering

Annual Losses:
1.5% of Sales
Increased EH&S Risk

Good Asset Information Requires an Appropriate AIM Strategy
Executive Overview

This series of reports discuss the critical issue of asset information management (AIM). Good asset information is fundamental to good asset performance and every person involved in operating and maintaining facilities needs appropriate information to do their jobs. For optimal performance, this information has to be complete, accurate, and comprehensive to support a multitude of questions about the asset’s creation, use, and care. Access must also be convenient so that people can use it in their decision-making.

Studies have identified poor AIM as the root cause of many asset performance problems, such as poor asset utilization, low maintenance efficiency, high MRO costs, etc. ARC estimates the costs of poor AIM for a typical asset-intensive organization to be 1.5 percent of sales revenues – a staggering burden for any company today. Poor AIM also increases the risk of safety, health and environmental incidents, which can jeopardize an enterprise’s very survival.

While the opportunity for improvement is incredible, many organizations continue to suffer the pains of poor AIM. Some don’t recognize the opportunity. Others understand that they have problems, but don’t know how to solve them or can’t justify the required investments.

This series of ARC reports on AIM addresses all these needs. This first report analyzes the staggering impact that poor AIM has on asset performance and outlines the requirements for a proper AIM strategy. Subsequent reports provide practical guidance on how organizations can develop and implement their own AIM strategies.
What’s Good AIM Worth?

While AIM is an interesting issue, no one today has the luxury to spend time on things that are not important to their organization. So we begin this report with a brief discussion of why we believe that every organization, regardless of how well it manages its operations, should consider AIM as a significant opportunity for improvement.

Our research indicates that better AIM can improve the performance of most facilities, financially and otherwise. Furthermore, the typical asset-intensive facility can reap annual savings equal to 1.5 percent of its sales revenue.

As the table in the sidebar shows, better AIM represents a staggering opportunity for industries, like refining and steel production, with large integrated facilities. The rewards can be just as incredible for large organizations in industries with distributed operations, as they can implement enterprise AIM strategies. As the savings are annual, even smaller organizations can benefit by including AIM in their continuous improvement programs.

### Evaluating the Opportunity

To assess the financial impact of poor AIM on asset performance, organizations need to consider three different areas – revenues, operating and maintenance costs (OPEX), and the capital costs of modifications and upgrades (CAPEX). Poor AIM significantly impacts all three and the effects are cumulative with respect to overall financial performance.

The opportunity will be different for every organization, according to industry, scale of operations, existing IT situation, etc. We have done an analysis for what our research indicates is a typical case and present this at the end of this report. As noted above, it indicates potential savings of 1.5 percent of sales. We document the analysis so that organization’s can use our methodology to do their own assessments.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Typical Facility Revenues (M$)</th>
<th>Annual Cost of Poor AIM (M$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refining</td>
<td>11,855</td>
<td>177.8</td>
</tr>
<tr>
<td>Chemical</td>
<td>210</td>
<td>3.2</td>
</tr>
<tr>
<td>Power</td>
<td>203</td>
<td>3.1</td>
</tr>
<tr>
<td>Steel</td>
<td>3,433</td>
<td>51.5</td>
</tr>
<tr>
<td>Mining</td>
<td>28</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Annual Facility Costs of Poor AIM
It is important to recognize that a good AIM strategy can improve asset performance across all performance metrics including EH&S (environmental, health, & safety) and sustainability.

Every organization, regardless of how well they are managing their operations, should consider AIM as a significant issue and opportunity.

Comparison of our estimates with related studies indicates that losses due to AIM may be even larger than our estimates. This may be due to factors we did not consider or to our use of overly conservative assumptions of the impacts. In either case, these other studies clearly support our call for immediate action.

**AIM Impacts All Asset Performance Metrics**

While the above discussion focused on financial benefits, it is important to recognize that a good AIM strategy can improve asset performance across all performance metrics including EH&S (environmental, health, & safety) and sustainability. Too often organizations discount non-financial performance benefits in their evaluation of IT opportunities. In the case of AIM, a good strategy can help the organization avoid significant financial penalties and other effects that might jeopardize the organization's reputation and very survival.
AIM’s Role in Asset Lifecycle Management

Good information management is important for every asset lifecycle management (ALM) activity. But the information and the information management challenges vary across different lifecycle stages. This led ARC to identify several different information management strategies for ALM. AIM is the strategy responsible for supporting asset performance management (APM), which spans all activities and stakeholders involved in the operation and maintenance of the organization’s asset investments.

While we have restricted AIM’s focus to APM, it is not an isolated issue. Information sharing is a natural part of ALM and AIM strategies have to be compatible with information management strategies used in the other major lifecycle stages. This includes the project information management (PIM) strategy employed by the organization’s project management team and its major design and build contractors, and the strategy used to support the organization’s asset and portfolio management (APIM) efforts.

From a content perspective, AIM focuses on asset information, which is defined in the next section. As will become apparent, a substantial portion of asset information is developed during the design and build lifecycle stages and transferred to the APM organization as part of the facility handover.

Many AIM problems originate from poor information handover and organizations must address this

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1 See Asset Lifecycle Performance Management – Managing Performance Across the Asset Lifecycle, ARC Advisory Group, August 2009
2 See Asset Performance Management (APM) – Managing Performance of Operating Assets, ARC Advisory Group, September 2009
in their AIM strategies\(^4\). This includes guidelines for acquiring and cataloging information in ways that meet the needs of operations and maintenance personnel, and organizational roles and relationships that enable AIM stakeholders to participate actively in asset information management during the project.

**What Is Asset Information?**

Organizations have many kinds of assets. ARC’s ALM research focuses on one specific class of assets – the facilities, technology, and infrastructure that organizations acquire to service their customers, constituents, and other stakeholders.

Normally, the distinguishing feature of these kinds of asset investments is that they are physical (as opposed to financial, intellectual property, brand image, etc.). But they also include significant investments in people to operate and maintain the facilities and the best practices needed to ensure that this is done efficiently and effectively. Furthermore, these complex investments have long lifetimes and span a series of lifecycle stages, including plan, design, procure, install, commission, operate & maintain, modify, and retire.

With this definition of “asset,” we define asset information as all information created about all the organization’s assets throughout their lifetimes, including information about physical entities, people, and processes.

At the risk of appearing circular, it is important to note that asset information is itself part of the asset investment. It is the virtual representation of the physical and human assets that the organization needs to understand and manage the other asset types. Also, asset information is equally important as the other asset types, as no facility can operate effectively without all three elements in place. Viewed from this perspective, it is clear that asset information management is also a key part of every APM program.

\(^4\) See ARC Advisory Group strategy reports *Asset Lifecycle Information Management: Managing All of Your Information Handover Challenges, Part I* (April 2010) and *Part II* (May 2010)
Asset Information Is Broad and Comprehensive

Enabling people to understand and manage their “real” assets is challenging and means that asset information has to encompass a wide range of information. Ideally, it will be able to support any reasonable question about any asset from any valid stakeholder, whether they are part of the organization or part of the organization’s APM ecosystem. This includes questions about the physical asset; how it should be used and cared for; and how it was created, used and cared for in the past so performance can be analyzed and improved.

There are many ways to categorize specific asset information content. The categories in the following chart represent a useful breakdown to demonstrate the breadth of AIM.

Asset Information Categories for an Effective AIM Strategy

The first thing to note about these categories is how we have segregated the content into two major groupings, reference data and activity records. Reference data is information that needs to be managed for change. Activity records, on the other hand, represent information about events that have occurred. They are not subject to change, so they don’t need change management.

These two major groupings are then broken down into several information categories. Each category supports a different kind of question about the asset. Reference data categories support questions about the asset’s function and capabilities, its physical design, and how people can safely and efficiently install, assemble, operate, and maintain the equipment. Activity record categories support questions about current asset performance and
how an asset was operated and maintained in the past. Organizations need this information to identify the root cause of problems and incidents as well as to take advantage of prior agreements, warranties, etc.

### Asset Information Has to Answer Many Different Kinds of Questions

These information categories provide a helpful checklist of things that organizations developing AIM strategies should consider. Organizations may choose different categories, but they still need to ensure that their scope supports the wide diversity of questions that may arise regarding the asset.

| Function | What is its role?  
| Design | What components?  
| History | What were the capabilities?  
| Status | How does it work?  
| Commercial | How are they connected?  
| Procedures | What parts do I need?  

| Regulator | Was it right for the task? Calcs?  
| Engineer | Was it failed? Test Results?  
| OEM Supplier | How was it installed?  
| Blowout | How was it used? Maintained?  
| Preventer | Have there been other incidents?  
| Operations | Why did it fail?  
| Manager | What are the requirements?  
| | What are its capabilities?  
| | Was it tested? When? How?  
| | Was it changed?  

### Reasonable Stakeholder Questions Span Categories – So All Categories Are Important!

It is also important to note that all of our information categories are important. Answering real questions from real stakeholders requires information from many different categories. Disregarding a category because it may seem less important will limit the usefulness of an organization’s asset in-
formation and thereby its asset performance, since it directly depends upon asset information.

**Asset Information Comes in Many Forms**

Corresponding with its physical counterpart, asset information will also have a very long lifetime. So AIM strategies need to recognize a wide variety of information forms. Information created for new facilities and modifications may be in electronic form (even if only as pdf files of scanned documents), but in existing facilities, hard copy still forms a large portion of the asset information.

**Many Forms and Complex Linkages Create Special Information Management Challenges**

Asset information also spans a wide range of content types, such as drawings, scanned images, GIS information, documents, and data. Many different, often proprietary, formats will exist. Furthermore, many of these items will be related through complex linkages that reflect information redundancies and other relationships that have to be considered in change management.

**What Is Good Asset Information Management?**

From a top-level perspective, the idea of good AIM is simple - organizations with good AIM always have “good” asset information. To be a bit more specific, we could say that good AIM means that
every APM stakeholder can consistently find all of the information he or she needs and trusts that it is accurate enough to use in their decision-making, without adjustment or wasteful crosschecking. Finally, at the strategy development level, we would say that good AIM means that the organization’s information and information systems satisfy all the following criteria:

- **Complete** - All information for every asset and for every reasonable stakeholder question

- **Accurate** - With respect to the real, existing situation within the facility, the people and the processes being used to manage the operations

- **Timely** - Reflects the current situation adequately for most stakeholder needs

- **Consistent** - Across all drawings, documents, databases, etc. and every version of this information being used

- **Secure** – Access is adequately controlled to ensure that users have what they need; are restricted from things they don’t; and the integrity of information is protected from accidental, and intentional, distortion

- **Accessible** – According to every stakeholder’s perspective of the assets

- **Understandable** – Presentation matches user’s needs and preferences

- **Actionable** – Supports stakeholder workflows and decision-making

- **Easily Shared** – To enable collaborative decision-making

Organizations that achieve these requirements should find that they normally meet the needs of most stakeholders, enabling them to leverage this valuable resource to drive better asset performance.

**Why Do You Need a Separate AIM Strategy?**

AIM may be only one of many information management challenges for asset-intensive organizations, but it is important in its own right and has some unique characteristics that demand separate consideration. We there-
fore recommend that organizations have separate AIM initiatives. However, many of the requirements for AIM are the same as those in other areas and organizations may want to address these needs by building on existing information practices and solutions. So AIM should also be viewed as an extension of the organization’s overall information management program.

This section reviews some of the “special” characteristics that distinguish AIM and the potential impact they might have on the IT strategy of a typical asset-intensive organization.

**Elements of an AIM Strategy**

Like any information management program, AIM is more than technology. Organizations must first establish policies and processes for how they want to manage their asset information. Then they will have to assign these responsibilities to real people and provide them the technology needed to ensure effective and efficient information management.

It is best for organizations to treat AIM as an enterprise-wide program. Asset information may be site-specific, but most of the information management challenges are common across all sites, so there are opportunities to leverage investments in people, processes, and technologies. An enterprise approach to AIM also enables organizations to benchmark APM performance and practices across sites.
**Hard Copies and Technical Information Formats**

Our earlier discussion of asset information already highlighted some characteristics of asset information that make it a different information management challenge. Hard copy legacy information and technical information are two items from that discussion that deserve further comment.

Hard copy information is not a new issue for most organizations. Every organization has to keep records and many are paper based. Also, many transactions, like invoices and purchase orders, continue to be paper-based, so dealing with hard copy is an ongoing issue. Suppliers of information management software recognize this need and most have incorporated scanning and OCR into their solutions. Many organizations have already made hard copies a “non-issue” by using these capabilities in their workflows and records management processes.

But much asset information, like engineering drawings, requires special scanning because of its size and age. OCR is also not very useful for graphical information, so scanned images are often the best that can be achieved. This limits the organization’s ability to extract required metadata automatically. Both of these increase the cost of conversion. Add to this the fact that wet signatures and stamps on drawings may still have to be preserved, and it is clear why hard copies will likely remain an important issue for asset information.

The preponderance of technical information in AIM also means that the IT organization will have to add new, possibly unfamiliar, information formats to the list of supported data types. This may also require custom extensions to the organization’s normal information management solutions and to the tools they provide users to view and analyze information.

Converting special formats to more generic forms, like pdf files, is one approach many organizations consider. It enables use of existing solutions, but it may make change management more complicated. Since good change management is fundamental to good AIM, this key decision must be made during AIM strategy development.
Standardization and Information Standards

Standardization and standards are important across the information management landscape. They reduce IT costs and enable organizations to share information externally. Not surprisingly, many asset-intensive organizations have already standardized many of their activities and many of these efforts are based upon industry standards when they are available.

Standardization is equally important for AIM to control diversity of formats and lower the cost of sharing. Performance benchmarking and collaboration are key strategies for driving higher asset performance and they are only enabled when everyone uses compatible concepts, descriptions, and naming conventions. MRO materials management is another area where standardized naming is critical to avoid the costs of redundant and obsolete parts.

While information categories may differ, organizations can address many of these AIM requirements with existing master data management (MDM) policies, procedures and solutions. Those without such a strategy will need to develop one for AIM, but they can also leverage this in other areas.

Standards are also important in AIM. But the dominant standards in AIM will likely be new to the IT organization, so education in this area should be part of the AIM strategy. Standards that should top the list include ISO 15926, ISO 14224, ISA95, and MIMOSA (note that ISA95 and MIMOSA are both part of a consortium of standards groups known as OpenO&M).

Asset Information Is Highly Distributed

Asset information is very broad because it has to support a diverse group of stakeholders, with a wide range of interests. They will have many questions about the assets and their management that require integrating information from many different categories and they reasonably expect the information system to provide all this information. They will also evaluate the information system on its ability to understand relationships between information and facilitate navigation to related information.
An asset information data model is mandatory...

This needs to be rich enough to support a very diverse set of information objects and a variety of relationships that capture key APM perspectives.

**Asset Information is a Broadly Distributed Resource**

While these are reasonable expectations, the distributed nature of asset information makes them difficult for organizations to satisfy. The many forms of information leads organizations to employ a variety of content management applications. These include document management (DMS), relational databases (RDB), engineering information management (EIM), master data management (MDM) and geospatial information systems (GIS). Much asset information is also buried within a multitude of APM and enterprise software applications, individual desktop PCs, websites and hard copy files.

Providing AIM work environments with access to all these applications can help users deal with this situation. Integrating applications is also important, as it can enable stakeholders to access asset information directly from within their normal workflows. But neither work environments or integrating applications will be very useful unless people know what they are looking for or where to find it. So an asset information data model is mandatory. This needs to be rich enough to support a very diverse set of information objects and a variety of relationships that capture key APM perspectives.

Distributed asset information also creates significant challenges for change management. First, information duplication has become commonplace in most APM organizations. Every group has its own copy of the information needed to do its job, and software applications encourage this as they often require information to reside in each group’s database. This environment
limits change management potential. Groups may keep their copies up to
date for the changes they make, but rarely do they care about the copies
that other groups may be using. The result is that everyone has a different
version of the truth.

Multiple Versions of the Truth Are Commonplace

Asset information quality is a big, but hidden problem in most organiza-
tions and it is difficult to control. Everyone says that their information is
good, but few trust other’s information. This leads to excessive re-checking
of information and tremendous efficiency losses across the APM organiza-
tion.

Information quality is another issue that may seem familiar to IT groups.
Policies may be transferrable, but many of the strategies that work in other
areas may not be adequate for asset information. For example, centralized
information management is not tenable for asset information given the ex-
sting situation in most organizations. In fact, leaving information
management to individual groups is beneficial; it exploits each group’s self-
interest in maintaining its own data.

An effective asset information strategy will establish appropriate gover-
nance policies that recognize these special characteristics. It’s also essential
to develop an appropriate asset information data model to provide the links
needed for distributing changes throughout the APM organization.
Asset Information Comes from Many Places

While asset information includes many internal transactions, a significant portion originates outside of the organization. The handover of information from contractors and suppliers when new assets are commissioned is probably the most obvious example.

This and other information exchanges with external parties require close management and should therefore be part of every AIM strategy. Poor performance in this area can quickly undermine the quality of an organization’s asset information and severely limit the benefits reaped from asset investments.

As noted earlier, ARC has developed a separate series of reports to help organizations develop effective information handover strategies.

Good AIM Is in the Eye of the Beholder

Addressing the issues above is fundamental to good AIM. But the requirements for an organization’s AIM strategy will also depend upon its specific APM needs, which can vary significantly according to industry, asset mix, asset management philosophy, etc.

For a refinery, the key issues might be integrating asset information with maintenance, safety and inspection systems, or with 3D plant models that enable better planning and faster troubleshooting. For a nuclear plant, ensuring that the facility’s configuration management meets regulatory requirements may be the foremost criteria.
The requirements for an organization’s AIM strategy will also depend upon its specific APM needs, which can vary significantly according to industry, asset mix, asset management philosophy, etc.

For industries where assets are highly distributed, like utilities and infrastructure, remote access and integrating GIS maps with work orders may be the primary concerns. Accurate, accessible information for MRO materials management can likewise top the list for organizations, like mining and upstream oil & gas, which consume a lot of materials and parts.

Outsourcing asset management will also impact AIM strategy decisions. Responsibility for many AIM activities will naturally shift to the organization’s contractors. Unfortunately, some owner/operators take this to mean that they have no need for an AIM strategy, and they suffer the consequences of higher outsourcing costs and limited bargaining power when contractors do a poor job. Smart companies recognize that asset information is a valuable part of their assets and ensure that contractor’s follow what they have defined as good AIM procedures.

Some Final Comments on AIM Requirements

In this section, we have tried to highlight some of the things about AIM that distinguishes it from other information management challenges. But, the simple fact is that there is too much variation in APM and information management programs for us to develop one common list. In the end, every organization will have to develop its own list of AIM requirements. Hopefully, the kinds of issues we raised will stimulate and give some direction to these internal discussions.

Regardless of individual needs, every AIM strategy should include plans for how the organization will address three key AIM issues:

- Ensuring that all information is properly acquired at handover and is accurate, complete, and consistent
- Every stakeholder and system is able to conveniently access it in whatever ways necessary to facilitate APM effectiveness and efficiency
- Information quality is consistently maintained throughout every asset’s complete lifetime

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Key Issues for Every AIM Strategy
AIM Costs for a Typical Organization

Earlier in this report we indicated that the typical asset-intensive facility can reap annual savings equal to 1.5 percent of its sales revenue. In this section we describe how we came to that conclusion and, in the process, offer a methodology that others can use to get a quick estimate of their AIM opportunities.

To assess the financial impact of poor AIM on asset performance, we consider three different areas – revenues, operating and maintenance costs (OPEX), and the capital costs of modifications and upgrades (CAPEX). Poor AIM significantly impacts all three and the impacts are cumulative with respect to overall financial performance.

Revenue Benefits of Good AIM

For-profit organizations invest in assets to generate profits for the organization. Revenue generation is fundamental to driving profits and overall equipment effectiveness (OEE) is a popular method for assessing a manufacturing facility’s revenue-generating performance. OEE can also be used to identify performance shortfalls in non-profit asset investments, by simply considering revenues to be a surrogate for all of the benefits being provided to the organization’s constituents.

OEE is often presented as a formula, but the concept originates from a logical analysis of productive time and how it can be wasted in the operation of a facility. Assuming that there is demand for the organization’s product,
productive time is equivalent to a facility’s revenue-generating capability and waste in time corresponds directly to loss of revenue. So this provides a convenient tool for discussing the ways that poor AIM can impact revenue.

An OEE Timeline View of Revenue Opportunity Losses

The chart above shows the traditional OEE timeline analysis of how productive time is lost and highlights the fact that poor asset information can impact each OEE category. It also illustrates how these individual contributions accumulate.

Using this as a guide, the following table shows our estimates of the impact poor asset information can have on the revenue-generating capability of a typical facility. As time corresponds directly to revenue in this approach, we have labeled the losses as percent of sales revenue from the facility.

<table>
<thead>
<tr>
<th>Loss as a % of Sales</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability Loss</td>
<td>0.50%</td>
</tr>
<tr>
<td>Utilization Loss</td>
<td>0.25%</td>
</tr>
<tr>
<td>Rate Loss</td>
<td>0.25%</td>
</tr>
<tr>
<td>Quality Loss</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

AIM Impact on OEE Timeline Categories
As you can see our estimates for revenue loss are based upon various assumptions. These reflect ARC’s direct experience with capital facilities in a variety of industries combined with input from selected clients. We’ve described these assumptions in the comments so readers can adjust them for their own situation. Note that we have ignored the role that poor asset information may play in quality problems. While this may be significant in some industries, our goal is to provide a conservative estimate that is relevant for all industries.

**OPEX Benefits of Good AIM**

Many studies identify significant increases in maintenance costs due to poor asset information. We analyzed these losses extensively in the recent ARC report on Information Handover and rely upon that report to explain the results indicated in the following table for direct labor costs. We’ve also indicated other references used in converting these losses to percent of sales in the figure.

MRO materials are a major expense for most asset-intensive organizations. ARC clients report that poor information contributes to excess inventory costs due to redundant materials, retention of obsolete materials, excessive expediting and special orders, etc. We’ve indicated the assumptions used in converting these losses as well as supporting references in the figure.

<table>
<thead>
<tr>
<th></th>
<th>Loss as a % of Sales</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Labor</td>
<td>0.20%</td>
<td>Per NIST and Maintenance study analysis in Information Handover Report – Part II¹</td>
</tr>
<tr>
<td>MRO Materials</td>
<td>0.10%</td>
<td>Assume MRO materials is 1% of sales² and 10% of this is waste due to asset info errors that lead to duplicate materials, carrying costs on excess and obsolete material, extra charges for rush orders, etc.</td>
</tr>
<tr>
<td>Indirect Labor</td>
<td>-</td>
<td>Inefficiency in purchasing, accounting, safety, etc. due to wrong and inaccessible information. Difficult to estimate effect and specific impact of asset info.</td>
</tr>
<tr>
<td>Total</td>
<td>0.30%</td>
<td>Total impact of poor asset information on operating and maintenance expenses generating activities.</td>
</tr>
</tbody>
</table>

1. Asset Lifecycle Information Management: Managing All of Your Handover Challenges, Part II – Developing Winning Strategies, ARC Advisory Group, May 2010

**AIM Impact on OPEX**

While we believe poor asset information also contributes to inefficiency in supporting departments, like purchasing, we have conservatively set the value for indirect labor to zero. Again, this impact will vary significantly
according to how organizations manage these activities and we strived to provide an estimate with broad relevance. However, we recommend that organizations still consider this in their own assessments, as they may find substantial waste.

**CAPEX Benefits of Good AIM**

The following table provides our estimate of how poor asset information can impact the cost of facility modifications. We have used some information from research that Intergraph made on the impact that poor management of change has on design costs for modifications. As noted earlier, change management is a critical issue for an effective AIM strategy. We’ve noted the assumptions used to convert the Intergraph data to annual sales revenue in the table.

<table>
<thead>
<tr>
<th>Loss as a % of Sales</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extra Design Costs</td>
<td>0.10%</td>
</tr>
<tr>
<td></td>
<td>From Intergraph study poor information represents 30% increase in engr costs. Assume engr costs are 10% of total capex giving a 3% increase in capex costs. Assume capex for mods is 30% of asset value, sales = asset value (to give an ROA of 10%) and such a mod occurs every 10 years.</td>
</tr>
<tr>
<td>Extended shutdown time</td>
<td>0.10%</td>
</tr>
<tr>
<td></td>
<td>Assume that poor information extends every plant shutdown for mods by 3 days, so 3 days of revenue is lost every 10 years.</td>
</tr>
<tr>
<td>Total</td>
<td>0.20%</td>
</tr>
<tr>
<td></td>
<td>Annual impact of poor asset information on modification costs. Impact per modification is 10 time this value.</td>
</tr>
</tbody>
</table>

**AIM Impact on CAPEX for Facility Modifications**

The impact of poor information on new facility startup appears in various construction industry studies. Unfortunately, there are no studies that address these costs for extensions to shutdowns of operating facilities, so we have used our own experience as a guide. Once again, we’ve included our assumptions in the comments to enable others to apply the methodology to their specific situation.

**ARC’s Estimates versus Other Studies**

While it’s always good to test one’s estimates against other relevant information, this can difficult if no comparable studies exist. With that caveat in mind, we’ve compared our estimates with the closest studies we could identify.
NIST’s estimate for the annual cost of this item was 0.4 percent of installed cost.

Our estimate is 0.2 percent of sales, which would be equivalent if revenues were two times asset cost. This would be a reasonable value for an industry where ROA is 10 percent, COGS is 70 percent of sales, and GSA is 15 percent of sales and a 33 percent corporate tax rate.

So the NIST study is consistent with our estimates.

A NIST\textsuperscript{5} study made in 2004 examined the Cost of Inadequate Interoperability in the US Capital Facilities Industry. While the primary focus was on information in the design and build lifecycle stages, the researchers did collect some information on the ultimate impact poor information had on operations in terms of delays. This corresponds somewhat to the direct labor portion of our OPEX cost estimates.

NIST estimates 0.4 percent of installed cost annually for this item. Our estimate is 0.2 percent of sales, which would be equivalent if revenues were two times asset cost. This would be a reasonable value for an industry where ROA is 10 percent, cost of goods sold (COGS) is 70 percent of sales, general sales and administration (GSA) is 15 percent of sales, and the corporate tax rate is 33 percent.

ARC and Intergraph surveyed approximately 300 people at Intergraph’s 2007 annual conference. In one question, we asked those surveyed to estimate the annual cost of poor information interoperability between their operating and major project groups. We roughly defined “interoperability” to mean any problems in effectively sharing information. Estimates represented a bell-shaped distribution centered on 3 to 5 percent of revenues.

As the people attending the event were primarily associated with engineering and projects, these assessments could arguably be considered an estimate of only the CAPEX impact.

Ruth Wallsgrove made a relevant and very interesting study in 2004. The study, which focused on the full cost of asset information, examined six UK companies.

She found that some organizations spent over 30 percent of their revenues on asset information management activities while the best companies spent only 25 percent, giving 5 percent as the cost of poor AIM.

This study aligns well with our interests and again indicates that our estimate of 1.5 percent may be too conservative.

Researcher, Ruth Wallsgrove, made a relevant and very interesting study in 2004. The study, which focused on the full cost of asset information, examined six UK companies. These included the two London underground infrastructure companies (called Infracos), which were the initiators of the benchmarking study, an electricity company, a water company, a rail company, and a nuclear company. In this case, the study focused on the full cost of asset information management. She found that some of these organizations spent over 30 percent of their revenues on asset information management activities. The best companies only spent 25 percent and, using our terminology, she associated this 5 percent gap with poor asset information management. She made some particularly enlightening comments about the problems:

“It looked generally as though much too little effort had been spent on making what information there is accessible to those who need it, in a form they can use. .... It is probably true to say that most organisations have, at one point or other, and in one form or another, collected most of the asset data they really need, and invested in IT systems to store it. Getting this to the right people in the right form, however, seems for some reason to be much harder for them.”

She also identified the following as major areas of inefficiency and wasted effort:

- Excess time spent accessing difficult to access information on capital projects
- Data collection costs for recollecting data that has already been collected or is not important
- Duplication of responsibility for asset data, especially for quality assurance on this data
- Excess time spent accessing data for investment planning, maintenance scheduling and associated regulatory reporting

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As a whole, these studies indicate that our estimates may be too conservative. This adds further urgency for organizations to launch initiatives to explore their own AIM opportunities.

**Some Final Comments about the Costs of Poor AIM**

Assessing the costs of poor information is always problematic. We all learn to accommodate problems in the information we use and this can lead to underestimates of the potential for improvement. We have done our best to avoid such bias in this analysis by independently identifying the ways that poor information can affect asset performance and assessing the potential impact. Costs will certainly vary for every organization, but we believe that our estimates are reasonable for a typical complex facility and show a compelling case for most organizations to develop an appropriate AIM strategy.

While an organization may appreciate the impact that poor asset information has on individual productivity, they may still neglect, or overly discount, the impact that good information can have on enabling effective collaboration and teamwork. These effects are hard to quantify, but the NIST report and other studies reveal their importance. Another issue that frequently is neglecting the value of small improvements. Small improvements in repeated activities generate significant long-term benefits.

We ignored EH&S (environmental, health & safety) benefits in our analysis because they are difficult to quantify, but they are clearly a top priority for many asset-intensive organizations. Availability of asset information is vital to ensuring that people follow defined procedures and crucial for identifying the root cause of incidents. In many industries, this alone should justify an initiative to assess the quality and management of all information used by the APM organization.
**Next Steps**

This report presents a compelling case for every organization to investigate the impact that poor AIM may be having on their performance. If your organization is like others, you will find some significant opportunities and your next thoughts should be on how to address those issues. The remaining reports in this series are intended to help by offering guidance in three ways:

- Developing an AIM strategy and implementation roadmap
- Selecting AIM solutions
- Identifying best practices for key AIM challenges

Please contact your ARC client manager or the author for more information about these reports or to suggest specific topics that ARC should consider.
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Acronym Reference: For a complete list of industry acronyms, refer to our web page at www.arcweb.com/Research/IndustryTerms/

AIM  Asset Information Management
ALIM Asset Lifecycle Information Management
ALM  Asset Lifecycle Management
APIM  Asset Portfolio Information Management
APM  Asset Performance Management
CAPEX Capital Expenditures
COGS  Cost of Goods Sold
DMS  Document Management System
EH&S Environmental, Health and Safety
EIM  Engineering Information Management
GIS  Geospatial Information System
GSA  General Sales & Administration
IT  Information Technology
KPI  Key Performance Indicator
MDM  Master Data Management
MRO  Maintenance, Repair, and Operations
NIST National Institute of Standards and Technology
OCR Optical Character Recognition
OEE Overall Equipment Effectiveness
O&M Operations & Maintenance
OPEX Operations Expenditure
PIM  Project Information Management
PPM  Project Performance Management
RDB  Relational Data Base
ROA  Return on Assets

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