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MRO Data Analytics & Business Intelligence

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Currently, there is considerable excitement and growth in the fields of data analytics and business intelligence (BI). This article serves as a primer, to inform and explain their relevance in the maintenance, repair and operations (MRO) domain and to illustrate some of the potential opportunities.

Background

Over the last 25 years, MRO activities have become almost entirely administered through the medium of computer systems. Initially, stand-alone computerized maintenance management systems (CMMSs) were deployed at single site level, some were developed in-house, while others were commercially available products. As software development became cheaper and personal computers appeared on every manager's desk, these management systems grew in complexity. A need for multi-site capability gave rise to a generation of enterprise asset management (EAM) systems. A requirement for integration with wider corporate financial and business management applications then brought about the growth of enterprise resource planning (ERP) systems, accelerated somewhat by the hyped fear of the possible Y2K bug. Many smaller system vendors were absorbed into larger businesses and, inevitably, some dominant ERP vendors emerged. The result has been global deployments of highly capable transactional systems. However, as the size of the system vendors supplying ERP systems grew alongside that of the industrial organizations adopting them, the rate of innovation within system product development started to fall away because of inevitable large organizational inertia.

Against this developmental backdrop, the pace of business change actually accelerated to address issues of globalization and rapidly fluctuating economic cycles. The business landscape is continually reforming. News of corporate acquisitions and mergers, often private equity backed, fill the financial pages. Investors are keen to identify and quickly realize the benefits possible through exploiting the economies of scale to maximize shareholder value.

Much of the business value in a modern organization, even an asset-intensive one, is locked in the data and processes that it uses in its day-to-day transactions. Inevitably, however, when two businesses come together, they are often found to be operating on different systems; they have different DNA. Yet, the basic transactional processes that go on in both, such as work orders, purchase orders, inventory management and so on, are the same. It is not uncommon to find two organizations separated by a common language. Standards are slowly evolving, which means key transactions are becoming more uniform in their structure and data more standardized. But this is a slow process not always embraced enthusiastically by system vendors who might not want to make it too easy for a business to migrate to a competitor's product.

Data Analytics: A New Technological Wave

The emerging field of data analytics, which at present is populated by smaller and nimbler vendors, has burgeoned in the last few years. This has

been fueled by a number of exciting technological factors. Among them are the emergence and widespread acceptance of cloud-based technology for business, adoption of tablet computers in the workplace and the step improvements in the presentational capability of modern browsers. However, coupled with the fact that technology now makes more things possible is an underlying need, or perhaps even a thirst, for what can be done. Users now have far higher expectations than just a few years ago. Up until now, much of the battle in the workplace has been one of successfully implementing and gaining acceptance of essential transactional systems. That cultural battle is now all but won. Older workers are comfortable with the concept of information technology and have seen and acknowledged its benefit. The new generation struggles to imagine how it could have been any other way. Couple this with the everyday familiarity people now have with the Internet, social media, tablet computing and the common usage of information technology at home to create high quality content themselves for others to see as opposed to simply consuming it, and it is evident that the imagination of employees is increasingly oriented towards thinking about what might be possible. They are completely comfortable with information technology as a concept and are running with it ever more confidently by using it as just another tool.

Organizations are now seeing employees at all levels thinking creatively about how they can leverage corporate data for competitive advantage and demanding the ability to do this on an everyday basis. Data analytics and BI tools fill the gap to satisfy this demand.

There have been some well-documented examples of data analytics tools being used to identify and predict crime patterns. Marketing functions within businesses are aggressively exploiting customer data by using analytic tools to further sales by unearthing latent consumer needs. Financial businesses have often led with complex tools to analyze vast amounts of market data. But what about MRO?

MRO Data Analytics: The Process

Most industrial organizations now have huge amounts of MRO data in various forms, offering a potential gold mine. The challenge is in efficiently aggregating this diverse data, giving it some uniform meaning and then analyzing the big, and ever-changing, picture to identify opportunities. It is all about the skilled conversion of raw data into meaningful business intelligence.

A typical large industrial organization stores its MRO information in various ways. Some will be isolated in "silos" and some will be interconnected and accessible to all across the business. Much of it will be dynamic, reflecting its transactional nature. There also will be a historical dimension. Often, there are

different systems broadly performing the same function in different geographical parts of the business. Data standards probably differ wildly.

The first step in the process is to aggregate all this information and ensure a mechanism is in place to update it at an appropriate frequency to reflect changes recorded in the day-to-day activities of the business. Methods vary and a number of different ones might be adopted to satisfy individual local requirements or limitations. Foremost of these is the synchronization of databases via secure, cloud-based tools, such as those offered in their Microsoft® Azure suite, which fortunately makes the process relatively simple compared to just a few years ago. Basically, the data has to be pulled back and replicated in one place, albeit a virtual one.

Once a successful data aggregation process has been established, there is an important intermediate step of data normalization. Poorly managed, this can become a resource consuming black hole. This is where working with partners who have a detailed understanding of MRO systems and processes pays massive dividends. Knowing your way around a database of customers' names and addresses is one thing, understanding the detailed construction of work order processes and material master formats, for example, is a whole other league. The normalization processes need to be configured in accordance with agreed business rules, then automated for continuous updating. Some effort may be required to clean MRO data and then repopulate the local host databases with the revised data. A pragmatic view needs to be adopted here to decide how much data cleaning effort is justified to achieve expected benefits. The Pareto principle often applies.

With the MRO data now aggregated and normalized to a standard that provides a useful level of uniformity across the business, it is in a state suitable for analysis. As a broad differentiator, analytics processes focus simply on portraying data in innovative ways, while BI tools build upon this data and, with further user input operating discrete applications, carry out specific tasks, adding further value to the data. An example would be analytic reports of stockholding values enhanced with niche BI tools that use the normalized inventory data as their input to calculate optimal stock levels using specialized algorithms.

Usually, businesses can initially envision a series of stock reports they wish to see developed from their data, which can be built and effectively hardwired. However, it soon becomes apparent that the list of desired reports needed across the business is potentially vast. What isn't clearly known is what all the reporting needs are and how they will evolve. This is where inbuilt system flexibility is essential. Allowing users to mine MRO information and configure their own reports by building upon the normalized data is key. Furthermore, the easier and more widespread the access is to the required BI tools, the more organizations find that their employees help themselves in identifying and exploiting business intelligence in even more diverse ways. Internet/Intranet deployment meets this need.

MRO Data Analytics and BI Tools: The Possibilities

A top candidate area for finding opportunities is within MRO inventory data. When purchasing and stock data are viewed as a whole across an entire business, fascinating information frequently comes to light. A few examples include local variations in supplier pricing, component commonality and inventory duplication between sites, and finding corporate opportunities to rebalance stock holdings by moving excess stock to demand points. Understanding that a business has multiple small- or medium-sized local accounts with a glob-

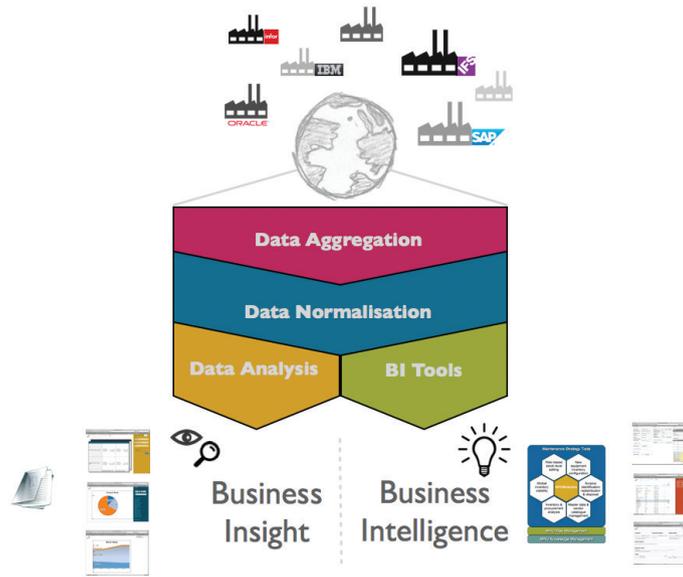


Figure 1: Business process diagram

al supplier, where the sum total expenditure should mean the business is a prime customer, can fundamentally change supplier/customer pricing negotiations conducted at a global level.

A comparison of metrics between operating sites for internal benchmarking can be extremely valuable. For example, seeing and understanding how different maintenance regimes and their resulting direct costs can impact reliability and availability of ostensibly similar assets in different locations.

It is not just about finding opportunities to drive down costs and improve efficiency. Increasingly for global corporations, there is shareholder ethical pressure to adopt unilateral standards for environmental and safety management. The first step towards this is to actually understand at board level what the aggregated corporate physical risk profile is and how it might vary on a site-by-site, day-by-day basis. A large portion of that physical risk is driven and managed by MRO activity. BI tools that help in reporting and analyzing the effectiveness of maintenance tasks at a global level are used to monitor this. Demonstrating effective global risk monitoring and control might be a regulatory compliance issue. Now that BI technology makes this possible, it increasingly puts pressure on all corporations to implement solutions that raise their standards in this field to meet the raised bar.

With large amounts of MRO data available, correlations between seemingly unrelated values sometimes become apparent. Of course, every competent engineer will understand that correlation does not necessarily imply causation, but it can illuminate potential areas for further evidence gathering. Patterns and cycles emerge that can be used to predict future events with greater certainty. For example, good mean time between failures (MTBF) data found on a large data set, combined with BI tools built to replicate probabilistic usage models, can be used to predict whether an asset has adequate logistic support to carry out a fixed mission profile with an acceptable level of certainty. Weather data, when cross-referenced with reliability data, might expose shortfalls in technical support that might be addressed to improve asset availability.

As organizations shift toward a policy of more openness with their corporate data, some businesses, in the spirit of gain sharing, are allowing consultants, suppliers and other stakeholders to independently analyze their aggregated corporate MRO data, frequently off site.

Conclusion

New data analytics techniques and innovative BI tools are now being used to "sweat" corporate data assets to bring about business improvement and fundamental change. MRO activities, with the associated huge amounts of transactional data they generate, represent an area of great opportunity. Domain specialists familiar with both underlying information technology and detailed business processes are emerging within this complex business area to work with global industrial organizations hungry for improvement. These projects may be trivial, but the rewards can be significant. The future has just started.



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