With all of the talk about leveraging the “right” smaller data sets, as well as the opportunity to leverage the explosion of “big data” being created by the emergence of the Internet of Things (IoT) in the manufacturing industries, it is interesting to see where the realistic state of the industry is in regards to the use of data analytics. It appears to be a forgone conclusion that data analytics is a key technology that is creating a new frontier for uncovering new insights that can speed decision-making and improve manufacturing business performance. However, the application of advanced analytics technologies is not without its challenges.

The questions answered and topics explored in this Research Spotlight are:

- What are the top strategic objectives and challenges of manufacturers and how do these relate to the potential use of analytics?
- What is the state of the manufacturing industries in regards to the use of the latest analytics techniques to improve operational and business performance?
- What are or what will be some of the key application areas and users of analytics for manufacturing?
- What are the key technology trends and issues associated with analytics?
- Where are some of the challenges in applying analytics today by manufacturers/producers?
- What steps should my company take to take advantage of analytics?

**LNS Research on Manufacturing Operations Management and Manufacturing Metrics**

The 2013-2014 LNS Research Manufacturing Operations Management (MOM) survey examined inputs from over 550 manufacturing business professionals across a broad range of industries. As part of this research, we explored the top strategic objectives and operational challenges, along with how innovative new approaches to this complex landscape of challenges are being addressed in order to provide unprecedented new gains in...
agility, productivity, quality, responsiveness, risk mitigation, and economic value generation. In addition to this research, related insights from a joint research project of over 350 professionals on manufacturing metrics between MESA International and LNS Research will also be referenced—“Metrics That Really Matter.”

**Top Strategic Objectives for Manufacturers Today**

The LNS Research MOM survey uncovered the summations of the Top #1, #2, and #3 Strategic Manufacturing Objectives from across a broad range of manufacturing industry participants. Represented were 37% from the discrete manufacturing industries, 17% from process manufacturing, 15% from food & beverage/consumer packaged goods, 12% from life sciences, and 19% from all other industries. It was refreshing to see that the top objectives were all related to serving customers. First and foremost is 66% of companies focused on ensuring consistent quality, followed by 56% of respondents focused on ensuring timely order fulfillment/responsiveness to customer demand. These areas of customer focus bode well for industries, given that if customers are not being properly served and satisfied, then nothing else will matter for a manufacturing business.

**Top Operational Challenges for Manufacturers Today**

When we look at the summation of the top #1, #2, and #3 associated challenges that manufacturing businesses are facing in meeting top strategic objectives, there are multiple simultaneous challenges that need to be addressed.
Basic data analytics capabilities can help to create these KPIs in a consistent and timely fashion.

Enterprise Manufacturing Intelligence (EMI) is another application ripe for better analytics.

The top operational challenge is how to break down silos of organizations and departments and foster greater collaboration. To a large degree, this is a leadership issue and this is also a failure point that we see in many organizations’ Operational Excellence journeys. Companies that effectively address this challenge are in a much better position to be agile in their responses to customers, to deliver superior products and services, and to be more efficient in doing so.

Having multiple departments sharing some of the same goals and objectives, and being on the same page with the same data, information, and Key Performance Indicators (KPIs) is another best practice that LNS Research has observed to help address this. Basic data analytics technologies can be utilized to create these KPIs in a consistent and timely fashion.

The next highest operational challenge that manufacturers have is getting the required data and information out of the many disparate systems and databases that exist across plants and enterprise. Manufacturers are looking to do this in order to support and sustain their process improvements. The ability to connect, federate, aggregate, analyze and contextualize data from multiple sources into useful and timely information is a key capability of today’s available manufacturing software solutions, such as Enterprise Manufacturing Intelligence (EMI). This is another application that is ripe for better and easier to use analytics.

The third highest challenge of creating ROI justifications for improvement investments is one that many companies struggle with. Benchmarking and researching what others in similar circumstances have done can help with understanding the range of potential
ROI. Putting an effective metrics program in place that includes baseline measures and real-time performance management is also critical to proving ROI. As will be discussed later in this report, more evidence of how analytics can play an important role in effective real-time performance management is needed.

**Maturity of Analytics Software Use for Manufacturers**

When asked which areas of MOM software were *least* mature in their organizations, Analytics was the second top response, just behind Safety & Risk Management software. This indicates that there is a long way to go before manufacturers are getting the most out of the potential that analytics technologies could offer. Other software application areas that are fairly mature in comparison include Overall Equipment Effectiveness (OEE), basic data collection & reporting, and software for the fundamental management of products, production, processes, materials, quality, etc. However, going forward we are seeing how all of these more mature areas of software applications can also benefit from the addition of better analytics going forward.

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In the next graph, we also see that the attitudes of manufacturers in regards to the business criticality of analytics software is somewhere in the middle of their mindsets. When asked which MOM software applications are most critical to their business success, analytics came up right in the middle of the list. This indicates to us that there is more to be understood and proven when it comes to the use of analytics within manufacturing operations. Next, we will further explore the trends surrounding applications of analytics by manufacturers.
Trends in Manufacturers’ Use of Analytics for Performance Management

More and more, we are seeing that companies are looking for combinations of business and operational analytics—especially for better managing performance metrics to drive financial improvements. Therefore, having analytics that can put operational information in business context is becoming an important requirement.

Our recent metrics research indicates that the typical scope of operational metrics is expanding well beyond the assets and productions areas of a plant. For 23% of the respondents, business unit level operational metrics are being measured and compared. And 35% are doing this as a corporate/enterprise scope of activities.
This same research also uncovered the fact that 65% of manufacturing operations managers are getting much more actively engaged in both business and manufacturing metrics on a daily or even more frequent basis. And there are more plant operators and supervisors that are not only seeing process control trends and statistical reports, but also operational analytics and metrics in real-time—so they can visualize the financial impact of their actions.

**Additional Real-time Analytics Use Cases by Role**

In addition to the aforementioned core manufacturing operations’ uses of analytics and metrics, real-time analytics are supporting the timeliness of information and decision making for these supporting roles and use cases:

**Quality Managers**

- Using analytics to evaluate the effectiveness of quality processes/workflows, in addition to the product quality attributes—using simple paretos
- Becoming more aware of the importance of end-to-end quality and the costs of good and poor quality by aggregating and analyzing quality results

**Quality Engineers**

- Using risk models to understand where product failures are likely to occur

**Maintenance Personnel**

- Primarily focused on asset availability (MTTR, MTBF), many are using RCM techniques; however, they are also using specific analytics technologies to predict/avoid failures or performance degradations (e.g. vibration, corrosion analysis)

65% of manufacturing operations managers are getting much more actively engaged in both business and manufacturing metrics on a daily or even more frequent basis.
Energy Directors

- Using analytics for real-time energy usage/cost optimization and tying energy use to asset performance and conditions

EHS Leaders

- Performing EHS modeling using process analytics for emissions/carbon reporting
- Operational Risk modeling—“what if” analysis that is tied to real-time risk registers, hazards, assets and impacts

Key Analytics Technology Trends & Issues

When looking across the landscape of different analytics technologies being applied across manufacturing businesses, there have been a number of different classifications of core systems and software application solutions employed. These include:

- Physical Process Design Analysis (e.g. plant/process design & simulation)
- Product Design Analysis (e.g. PLM)
- Work Process/Business Process Analysis (e.g. BPM)
- Product Attributes Analysis & Traceability (e.g. MES, Track/Trace)
- Quality Management (e.g. SPC, Reliability)
- Performance Metrics Analysis & Generation (e.g. Data Historians, EMI, BI)
- General Purpose Analysis (e.g. Microsoft Excel)

Since many of the above systems and applications are already in place and widely used, the databases and software basis for future analytics technologies is already in place for many organizations. However, there are some key new trends that we see occurring in relation to analytics:

- Analytic engines are moving to the cloud as well as to “edge computing” or embedded devices—so analytics are becoming more pervasive.
- Powerful new Platforms as a Service (PaaS) analytics processing engines like open source Hadoop, SAP’s HANA architecture, and IBM’s Watson are being applied to a wide range of business and line of business applications. We see these easily scalable, cloud-based analytics engines being applied more and more in the future in places where specialized analytics were utilized in the past. This is due to faster and less expensive computing techniques along with a
growing awareness on how to more effectively harness large sets of unstructured data—big data.

- Technology providers are actively working on making advanced analytics easier to use by both sophisticated and casual users. These new-generation analytics will need to be a future requirement for manufacturing organizations to be successful.

- In general, we see three main classifications for analytics toolsets based on the sophistication/type of user: 1.) Tools for preparing analytics for end-users by IT or engineering professionals, 2.) Tools that support self-service, ad-hoc analytics, and 3.) More sophisticated tools for data analysts/designers/scientists.

- Today’s expectation is that analytics tools and information is delivered “on demand” and with exception notifications and alerts being automatically sent to the computing devices of choice—based on different classifications of users: 1.) Web browser clients (general users), 2.) Mobile apps (general users & management), and 3.) Rich clients (especially for sophisticated users).

- Combinations of traditional and emerging IoT architectures will need to be supported with new generation analytics. Therefore, a combination of existing databases and applications as well as both small and big data needs to be analyzed utilizing common tools. In the latest IoT World Forum reference architecture diagram above, you will see combinations of embedded, edge- and cloud-based computing and analytics.
Lastly, we see many equipment, automation, and IT supplier companies starting to use analytics as enabling engine behind selling performance, service levels and results rather than just products. And we see this business trend accelerating in the future.

Steps Your Company Should Consider to Take Advantage of Analytics Technologies

- If you are not already using analytics technologies to better understand your manufacturing business performance, get started with a solution that can address a subset of your most critical manufacturing metrics in support of continuous improvements.
- As a next step, look to expand the use of analytics to evaluate other areas of your production operations—such as quality, asset performance/maintenance, energy, EHS, etc.
- As your organization becomes more comfortable relying on software and “purpose built” analytics to proactively manage your operations, look for ways to utilize more advanced analytics that can help you evaluate end-to-end production and business processes that include opportunities for optimizing the bigger picture of your supply and demand chain.
- Take the time with a small IT/engineering and operations team to evaluate some of the newer IoT and cloud-based, unstructured big data analytics tools, and how they may be readily applied to scale improve your manufacturing business.
- Look for suppliers with a proven track record of applying these newer IoT and cloud/big data analytics to solve manufacturing business problems.
- As part of your company’s future business models, consider utilizing analytics technologies and remote connections to provide additional value via new performance contracting or service opportunities.