Future of Metal Manufacturing

Unleashing Productivity, Profitability with Business, Manufacturing and Operational Intelligence

Energy & Resources Industry

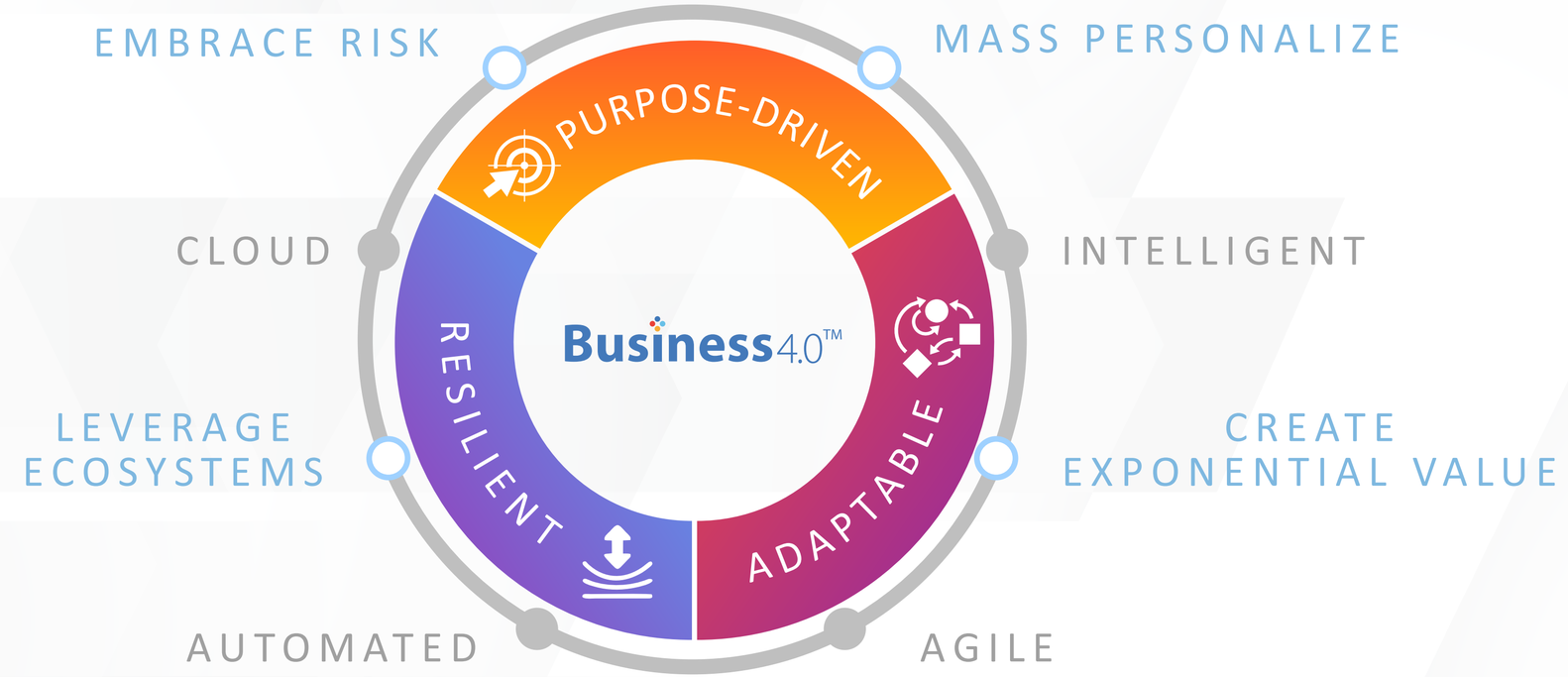
PURPOSE-DRIVEN

RESILIENT

ADAPTABLE

PURPOSE-DRIVEN, RESILIENT & ADAPTABLE

with Business 4.0™



TATA CONSULTANCY SERVICES

Abstract

Time series and non-time series data has presence on all levels in a traditional business model, as per ISA S95 manufacturing standards. Additionally, master data and transactional data is contextually structured for each level. However, as all the data is not information, leveraging the expertise of architects, data scientists, designers, developers and integrators is crucial to put data and information to work for enhanced decision-making.

Over capacity, aging work force, heavy debt and cash flow issues can sometimes hamper data-driven decision making. Leveraging Business 4.0™ enablers such as cloud computing, artificial intelligence (AI), automation, big data and analytics, and IoT are key to sustainable growth. When combined with the right tools as well as adoption of top to bottom, bottom to top and hybrid approaches, this can help derive business intelligence, manufacturing intelligence and operational intelligence.

This paper throws light on deploying extraction, transformation, loading (ETL) technologies combined with cutting edge slicing and dicing mechanisms to help extract contextual key performance indicators (KPIs) in manufacturing and metals manufacturing. It also elaborates the approach for successful deployment of ETL technologies, from selecting the right data source to finalizing slicing and dicing mechanisms, for successful implementation of intelligence in metals manufacturing. It also touches upon the role of analytics in disaster management such as natural calamities, and pandemic situations due to biological outbreak, total shutdown and so on.

Business intelligence KPIs for optimizing supplier cost and improving services

Most metal manufacturing companies rely on crucial KPIs related with suppliers, finance, accounts, customers and markets to accelerate business decisions. For instance, KPIs related to supplier analysis can help data manufacturers improve supplier services by enhancing regulatory compliance or by discontinuing contracts. By applying KPI Cube or SupCube, manufacturers can effectively perform supplier analysis on parameters such as cost, timeline and quality. Similarly appropriate analysis can help enhance KPIs such as Just in Time (JIT) compliances and lead time, as well as quality of supplier material such as equipment, machinery, devices used in instrumentation and process control, raw material, packing material, heat generation material, IT related hardware and software, and utility related material.

This helps optimize supplier cost through actual cost analysis and deliver value added services. In addition, defining organizational business strategy requires meeting sales and tax related KPIs and interfacing with Finance and Commerce (FICO) systems while considering country specific tax guideline and various acts and impacts analysis. Moreover, metals manufacturers and their IT partners also need to drive insights from multidimensional data about customer product line, geography, and market conditions to decision makers. This helps boost campaign management, Make to Order (MTO) and Stock to Order (STO) decisions, empowering monthly quarterly and yearly rolling planning.

Manufacturing intelligence KPIs for boosting utilization and quality

With digital transformation of the manufacturing industry, integrating manufacturing intelligence means understanding the KPIs related to sales order to production order conversion, detailed campaign analysis, product tracking and genealogy analysis and planned against actual production. At the same time enabling capacity and quality analysis is crucial to enhance utilization and predict produced material quality based on statistical data. Additionally, enabling equipment simulation and performance analysis based on digital twin not only ensures quality prediction but also helps trigger predictive maintenance. Similarly, analysis of accurate and timely message exchange between the Manufacturing Execution System (MES) and peripheral applications helps enhance the performance of manufacturing IT landscape. This requires quantity, quality and timeline analysis of Production Order (PO), production plan, production schedule, inspection plan, Process Data Input (PDI), Process Data Output (PDO), material allocation and goods movement messages. The analytics journey from descriptive to prescriptive is crucial for successful digital transformation of the organization. (See Figure 1.)

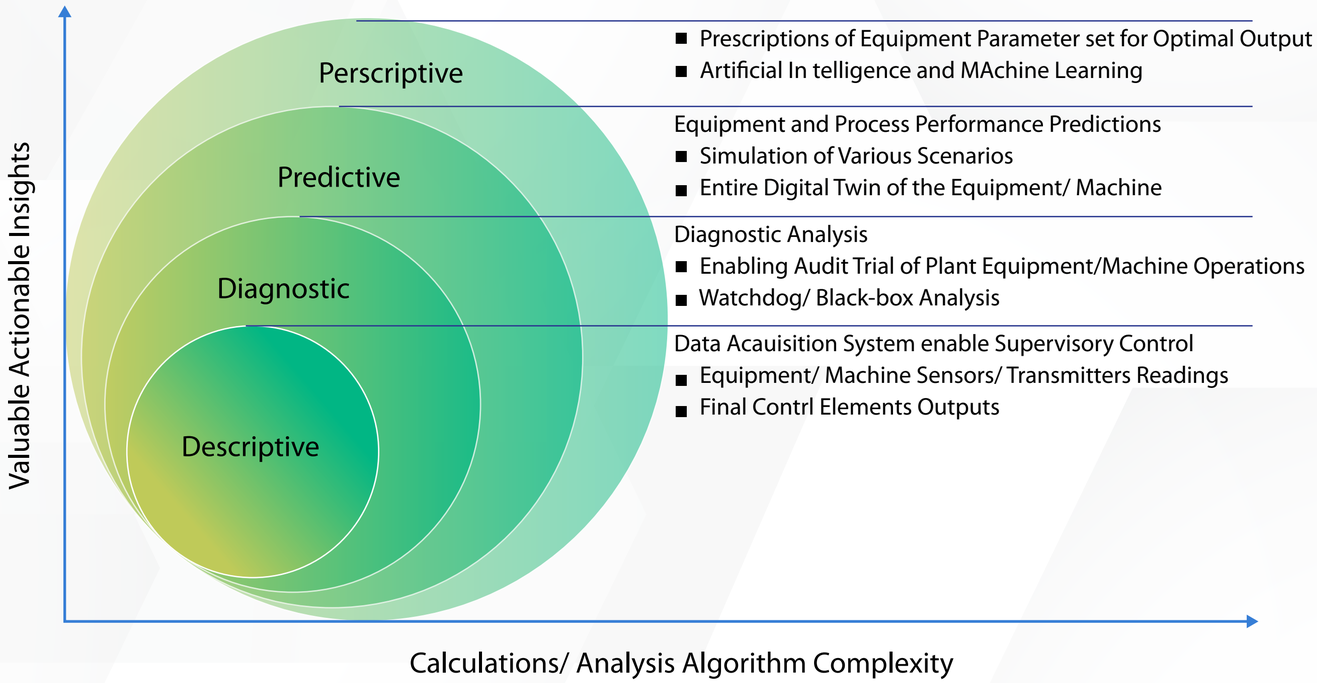
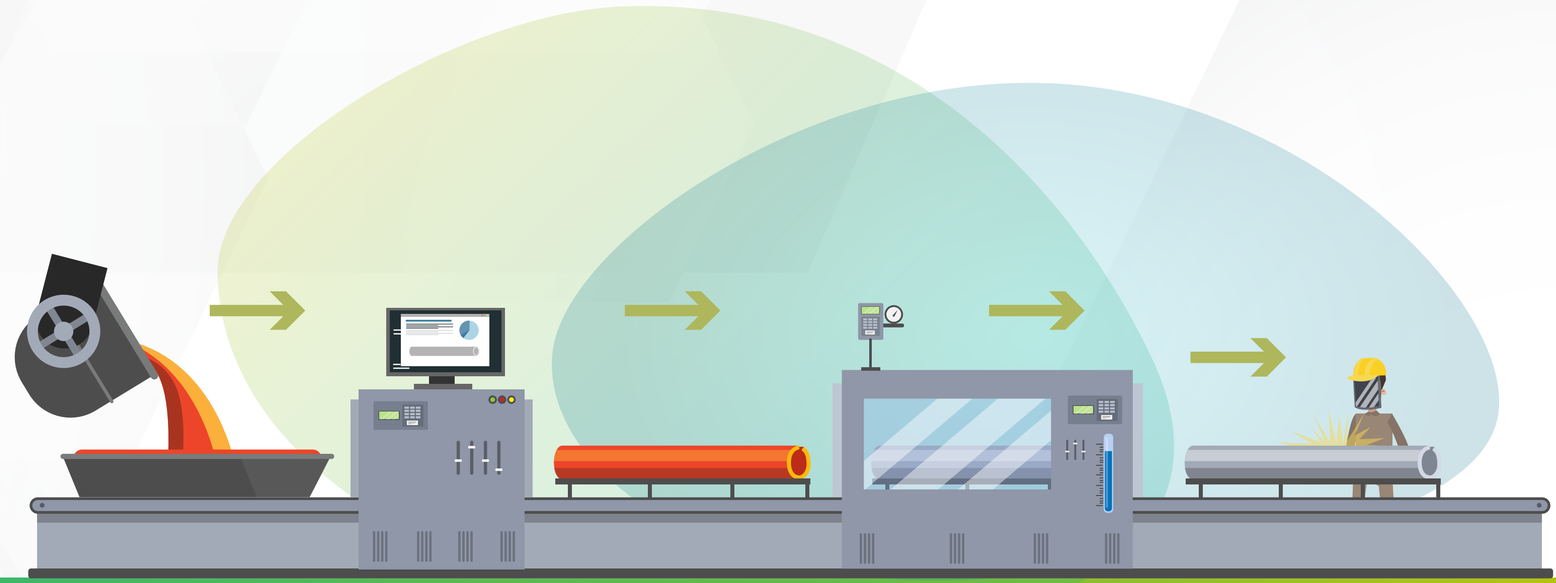


Figure 1: Machine Analytics Maturity Journey

Operational intelligence KPIs for taming data and refining business processes

Similarly, implementing operational intelligence in metals manufacturing is imperative for tactical decision-making. However, this requires taking control of operational data and improving business processes such as procure to pay, idea to offering, market to order, quote to cash, order to cash, RMA (Return Material Authorization), sales return cycle, forecast to delivery, financial plan to report, issue to resolution and plan to inventory. Leveraging Real time Online Transactional Processing (OLTP) and Online Analytical Processing (OLAP) is one way to analyze business process transactions as they happen. This ensures successful implementation of operational intelligence. For instance, organizations can leverage rightly configured DWH for black box analysis of operations in disaster management scenarios such as natural calamities, biological outbreak such as COVID-19 and total lockdown.



Six ways for successful implementation of business, manufacturing, and operational intelligence

Successful implementation of business, manufacturing and operational intelligence in organizations requires readiness assessment of the IT landscape, ETL technologies, enhanced change management and IT security planning. This requires understanding stakeholder and system requirements by conducting stakeholder interviews and workshops, establishing architectural models, and getting interface, operational and component views. Crucial steps to successfully implement intelligence in metals manufacturing include (see figure.2):

Identifying the right data sources

In most organizations, data sources for business, manufacturing, and operational intelligence can be similar. However, in a typical scenario for most organizations, the enterprise resource planning system is the most crucial data source for enabling business intelligence and internal transactional systems for operational intelligence data sources. Similarly, instrumentation and process control systems, manufacturing execution systems, predictive model control systems and advanced process control systems are crucial for enabling manufacturing intelligence.

Extracting data from data source

Typical data sources in manufacturing IT landscape are Process Control Systems (PLC, SCADA, DCS, OPC), Historians, MES, LIMS, CMMS (Computerized Maintenance Management System), Warehouse, Production, Quality, ERP, Planning and Scheduling Systems. The extraction is possible in the form of Comma/Tab separated values, XML, SOAP, Web Services, DB Link, MQ, JSON and Binary Objects. Various APIs supporting IoT system are also available for extracting data.

Staging data in landing zone

As a majority of data sources are in production environment and there is more than one data source, keeping a landing zone is an essential practice. This helps protect data source as well as create and configure delta updates.

Transforming data

Cleansing and normalizing data is crucial for removing noise from data, for enabling seamless reporting and analysis. This requires scaling of data, changing engineering units of the data, designing specifics schemas on the data and making the data ready for appropriate mathematical, statistical and logical calculations.

Loading data

This requires feeding data into destination and target system databases. This in turn helps create views and schemas based on the business, operational and business intelligence KPIs.

Designing, developing and deploying analytics

Making views and schemas based on the above described KPIs in BI, MI and OI is essential. For better user experience (UX), it is extremely important to create views that can be hosted either on cloud or within the landscape. Organizations can also provide access to reports, dashboards and analysis services to the right users based on the requirements of functional KPIs and on the role and authorization policy of the organization. Super users can also perform slicing and dicing mechanisms for multidimensional analysis to make decisions. With the right combination of self service and custom reports, analytics can be deployed successfully. This process can be well designed through analytical process designer tools based on the chosen analytics platform.

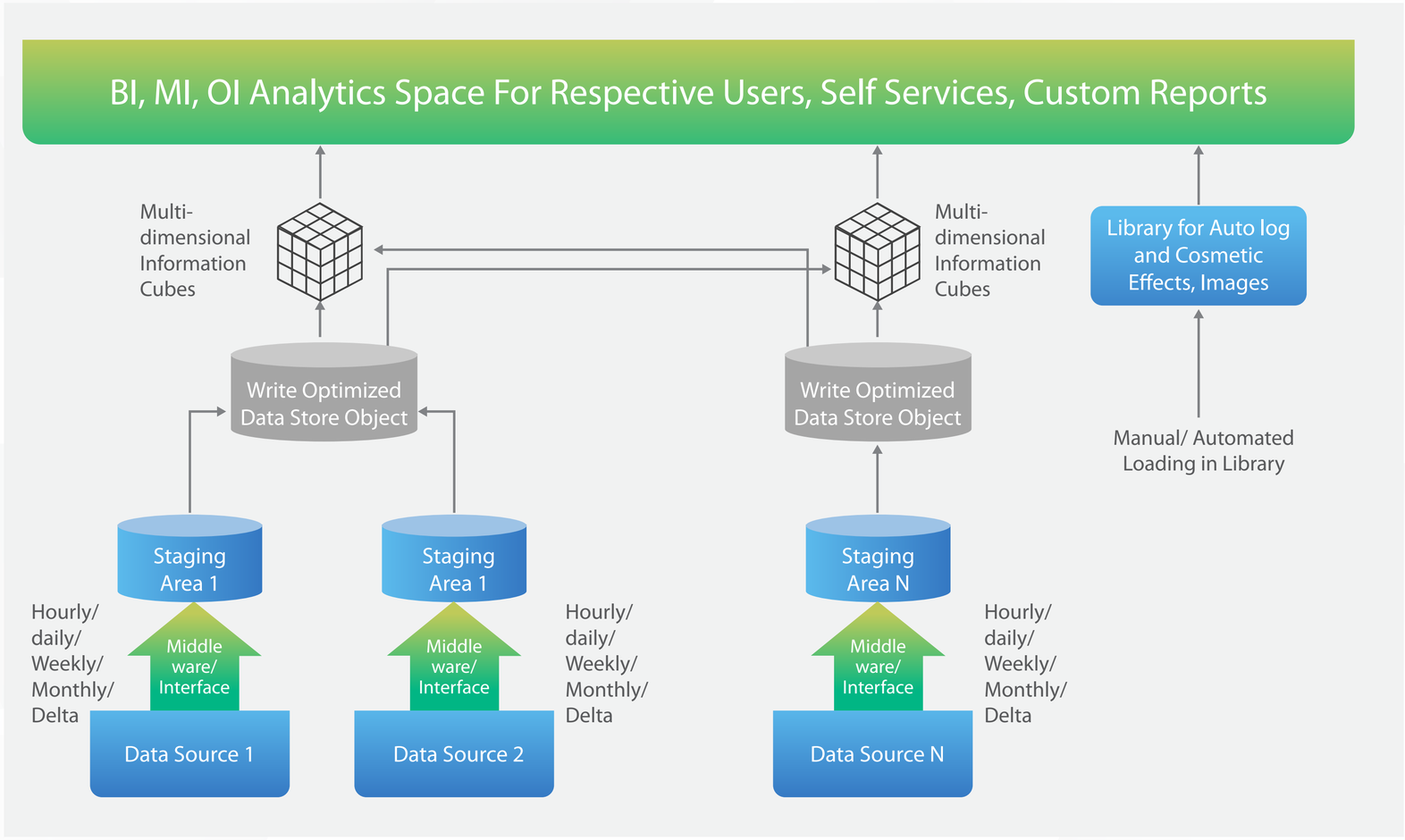


Figure 2: ETL Architecture for Successful Intelligence Implementation

Steering Metal Manufacturing into the Business 4.0 Era

In the era of digital transformation and Business 4.0, data is the new currency. It helps drive actionable insights from various equipment, business processes, and ERP systems and is crucial to enhance business value in metal manufacturing. This requires combining data from multiple resources and developing a data transformation strategy for empowering business, manufacturing and operational process, for enhanced business outcome. Readiness Assessment of the IT landscape is also crucial for successful implementation of BI, MI, and OI. This means conducting stakeholder interviews or workshops and analyzing IT landscape to understand problem areas, stakeholder concerns and system requirements. Architectural models, views and processes should also be established to add value to the organization while interface, operational and component views should help IT teams and users manage new way of working.

About the Authors

Vidula Joshi

Vidula Joshi is a project manager in TCS, managing projects in Metals, in E&R and in the ERUG group of EIS. She has over 17 years of experience in process control, MES and business intelligence, and has successfully delivered projects across power, energy, food and beverages and metal customers. Vidula has also lent her expertise in solution architecture, development & support, managing of varied projects, and delivering training in instrumentation, industrial automation and MES. She holds the distinction of being the first female instructor to conduct training for TUV (on Advanced SCADA) in the Middle East. She holds a Bachelor's Degree in Power Electronics Engineering from BDCOE, Sewagram, India. She has certifications on various products and platforms such as GE Proficy suit and SAP BI along with multiple TCS internal certifications.

Venkatesh Patil

Venkatesh Patil heads the Engineering and Industry Solutions (EIS) group for Energy, Utilities, Resources and Government domains. He has a Masters degree in Engineering and 25+ years of rich experience in IT. He has been supporting global customers of TCS improve and optimize operations in the areas such as plant solutions, asset management, control systems, and plant information management.

Contact

Visit the Energy, Resources and Utility page on https://www.tcs.com

Email: er.marketing@tcs.com

About Tata Consultancy Services Ltd (TCS)

Tata Consultancy Services is an IT services, consulting and business solutions organization that delivers real results to global business, ensuring a level of certainty no other firm can match.

TCS offers a consulting-led, integrated portfolio of IT and IT-enabled infrastructure, engineering and assurance services. This is delivered through its unique Global Network Delivery Model™, recognized as the benchmark of excellence in software development. A part of the Tata Group, India's largest industrial conglomerate, TCS has a global footprint and is listed on the National Stock Exchange and Bombay Stock Exchange in India.

For more information, visit us at **www.tcs.com**

Corporate Marketing | Design Services | M | 07 | 20

PURPOSE-DRIVEN

RESILIENT

ADAPTABLE