2022

IF DATA IS THE NEW GOLD, WHERE DO WE DIG?

A whitepaper on data as a critical company resource.

WWW.KINSMENGROUP.COM
info@kinsmengroup.com
+1 713-725-0143

KINSMEN GROUP

KINSMEN GROUP

“What steam was to the 18th century, electricity to the 19th and hydrocarbons to the 20th, data will be to the 21st century,” said Rometty, chairman, president, and chief executive officer of IBM. “That’s why I call data a new natural resource.”

Companies understand that information is of strategic importance and critical to the success of any organization. Every part of an organization is making decisions daily, based on data they collect, process, analyze, and review. The global pandemic heightened the need for digital transformation for all organizations in all industries and, process manufacturers are no exception.

The rise of Industry 4.0 technologies has further driven this trend and with more and more data available, organizations are struggling to reap the benefits of this data.

At the same time, the industry acknowledges that poor engineering information can have real and significant impacts, but little research has been done to quantify this. In this mix of promises, the need to improve, data overload, and challenging data quality, companies are struggling to define where and how to start.

This whitepaper focuses on an organization’s quest for new gold to transform data into a decision-making asset.

STRATEGY

Understand the maturity of your information, detail how it is managed, used & shared. Develop a plan of action to conquer information chaos & quantify the value & ROI for optimization.

SOLUTION

Leading-edge, information management solution to help optimize operations and maintenance, capital projects, handover, and asset acquisition information. Solution deployments, upgrades, renovations and more.

SUCCCESS

Beyond software, get unbeatable support and system administration. Training, onboarding and change management for your people, outsource document control and CAD drafting for your Capital projects.

What is data for Owner Operators?

Owner Operators collect vast amounts of data. One way to describe the types of data being recorded is to look at the various levels of the Manufacturing Execution System (MES). The MES system is the culmination of tools and technologies used at various levels to manage the operations of the facility. Often the MES is also displayed as the automation pyramid for which a sample is shown in Figure 1.

Figure 1 – Manufacturing Execution System Pyramid

Let us look at each of these levels and see what type of data is being collected.

- Level 1: Control & Field – At this level, the input from the field is generated by sensors and equipment available in the field. Temperature, pressure, rotational speed, valve status, and many other variables are generated at extremely high increments. The inputs generated at this level are provided to the second level in the pyramid.

- Level 2: Operations – The second level provides low-level automation in the form of Programmable Logic Controllers (PLC's) which ensure basic controls for individual systems and operate and respond at very high speeds.

- Level 3: MES – The third level is the MES level; often in the form of a DCS or SCADA system. There are obvious differences, but for this article their function is the same, which is to provide overarching control of the facility across multiple systems. Click here for a good overview of those differences: https://realpars.com/dcs-vs-scada/.

- Level 4: ERP – The ERP level provides integrated resource planning and controls the planning and resources required to generate the desired production.

Each lower level can produce data which can be used by a higher level to create a more integrated system. Research on this integration suggests that to reap the full benefits of industry 4.0 technologies and utilize Digital Twin's, data needs to be aligned at all levels [2].

A second description of the data being generated is the supporting data used to ensure safe and compliant operations such as drawings, specifications, environmental reports, work processes for Management of Change, training records, and many others. Where the MES generates vast amounts of transactional and real-time data, the supporting data is more static. With the data being more static, the change controls put in place on this data are rigorous to ensure the safety and compliance of the facility.

When both types of data are presented in one overview, it becomes more evident how they interact and the importance playoff each in day-to-day operations. This is displayed in Figure 2.

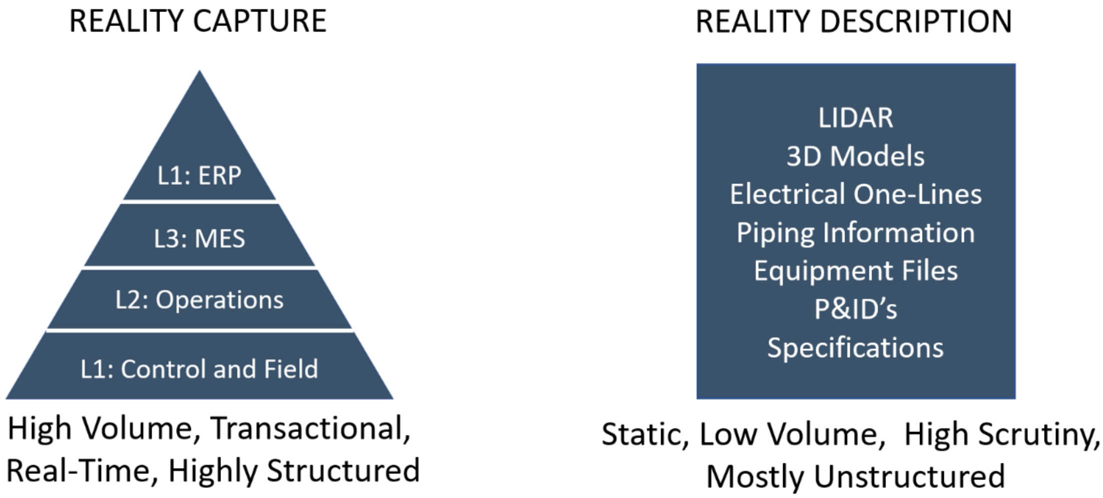


Figure 2 - Transactional and static data

Figure 2 is an overview of the two important data sets. There are many interaction points and operators, engineers, planners, and project managers will use both data sets daily to operate the facility. In an ideal world, the data sets are aligned, represent reality, and support the operation. The truth; however, is very often different as we see companies struggling to keep the data updated both vertically and horizontally across both data sets. During the 2012 OTC conference, it was stated that there is often a **12-month** lag time between the real world and all information systems being correctly updated [3,p. 10].

What is the impact of poor data?

So companies struggle to maintain information. So, what; why does it matter? Engineering Information Management professionals agree that poor information has an impact, but in researching this issue, they have found that quantifying the impact can be difficult. And, in general, research on this issue is limited. The common focus is around safety, compliance, efficiency, improving equipment reliability, and so forth. Let us review these in more detail and see if there is a business case to be made before we start digging.

- **Trust - 50% or worse**, from a limited poll during a live event, among process manufacturing companies, 50% of the attendees rated the trust level of their information at 50% or worse. Meaning that at a minimum a field-check is required, and multiple systems would need to be verified, before committing changes to critical information [4].

- **Perceived reliability - 60%,** from a study conducted in 2016 amongst 9 petroleum production facilities and 133 interviews, 60% of the group describes that communication & access to information, combined with the efficiency of the tools available have a considerable influence – in a negative way – on the perceived reliability of the equipment [5].

- **Safety / Incidents - 86%,** When an incident (or near miss) happens, 86% of the attendees believed that poor, missing, and or not timely information was a large contributing factor to the event. This was a question asked during a live event amongst process manufacturing companies [4].

- **Cost – 10% of the Operating budget**, from a recent study in 2019, it was concluded that up to 10% of an annual operating budget could be lost because of poor engineering information. Many variables are used and depending on the specific situation these numbers will vary a lot. However, the range of potential cost is significant for any asset which provides a solid start for a business case.

info@kinsmengroup.com
+1 713-725-0143

- **Cost – 1.5% of annual revenue** – from research performed by ARC Advisory group it was found that the cost of poor asset information can be upwards of 1.5% of an organization's annual revenue. Throughout this study, these numbers were validated against other known studies to contrast and compare and validate the outcome of the study [6].

- **Cost – 15.8 billion per year** – from a well-known report produced by the National Institute of Standards and Technologies, it was estimated that the inadequate interoperability of information is costing the capital facility industry a staggering amount yearly. Although this study was performed in 2004, reviewing some of the more recent research shown above, the presented number still appears relevant [7].

With this knowledge, it should be easy to convince leadership that investing in improving the quality of information is of foremost importance The reality; however, is very different given that most of these figures represent soft and or indirect savings and results that require not only a system, but also organizational changes in culture, structure, and work methods to fully reap the benefits. The most recent research from Volk and Coetzer has produced a taxonomy showing an overview of the cost involved with poor engineering information for a facility [8]. Figure 3 shows an overview of the defined taxonomy.

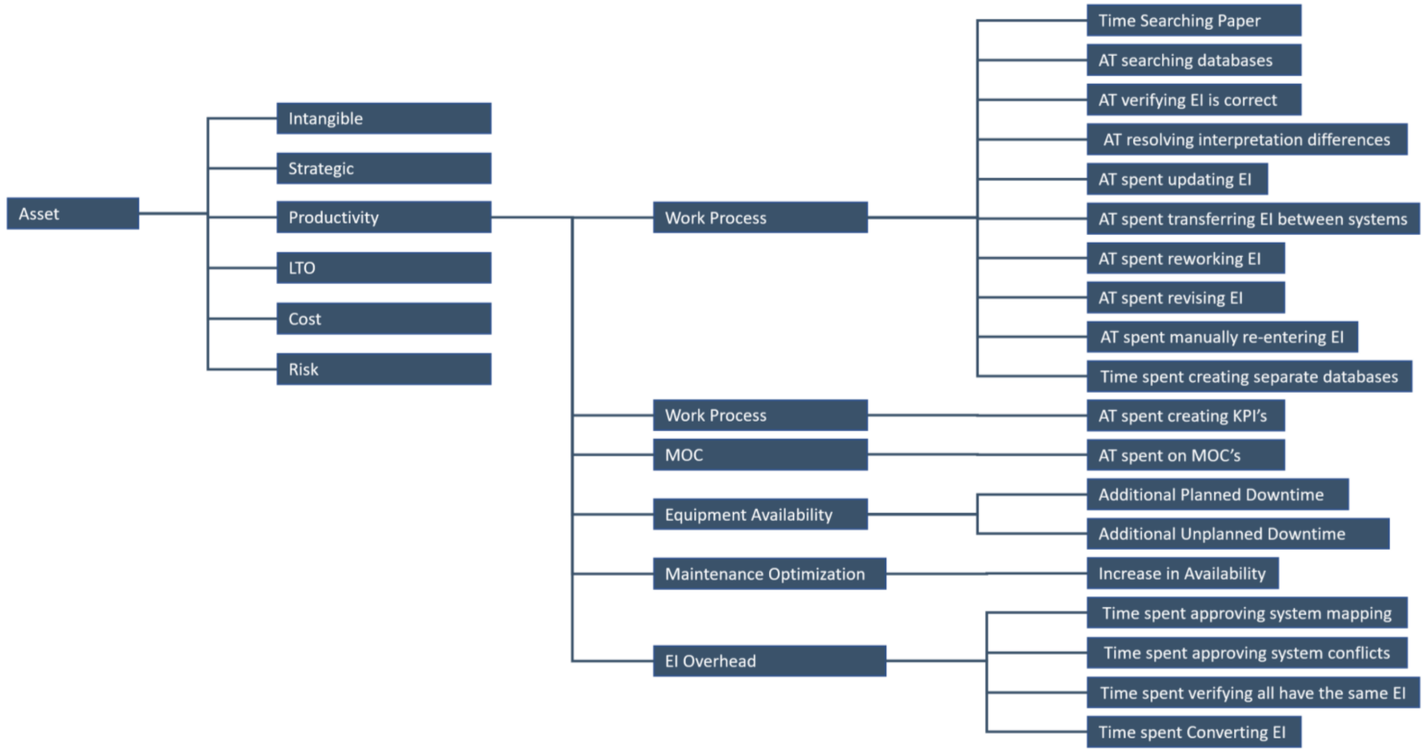


Figure 3 - EI Cost Taxonomy (Coetzer)

Executives have grown weary of large IT projects that take a lot of time and appear to have limited hard benefits. While improving data quality sounds a bit mundane; coupling data quality with Digital Transformation and improving how business is conducted will have a higher chance of arriving at the executive agenda.

To provide some practical guidance, Frank et all, describe stages of industry 4.0 implementation patterns, where vertical integration of information systems is one of the elementary steps to allow a company more advanced scenario. In the first stage, most companies focus on vertical system integration, energy management, and traceability of materials. The second stage will focus on automation and virtualization. The last stage will focus on making the production process more flexible [9].

From different points of view, we now see that the quality and integration of data is essential for not only improving the current operation but also for embarking on any type of transformation project. As the journey continues, establishing the meaning of data quality is an integral part of this quest.

What is data quality?

Throughout this whitepaper, the terms data and information have both been used. Although these terms are used interchangeably from time to time, there are clear differences. Among academics, similar definitions emerge. Data is defined as a discrete and objective description of events; for example, a temperature reading for an instrument in the facility or a listing of dates for approved changes to the facility. Information is defined as data that has been transformed to add value in a specific context by condensing, categorizing, and other means to support the decision-making process [10]. A good example in this sense is to use the database with recorded changes (MOC's) to find trends related to equipment. Are specific pieces of equipment more prone to failure compared to others is a valid question that could influence buying and replacement decisions.

Another popular buzzword in this discussion is "BIG" data. The obvious point to look for big data applications is like the automation pyramid with technologies such as predictive maintenance. In the context of big data, there is often a reference to the five V's. Volume, Variety, Velocity, Veracity, and Value. Very simply, Volume speaks to large amounts of data either stored or in transit, Variety speaks to both structured and unstructured data and a wide variety of data sources, Velocity speaks to the speed at which the data increases, often this is at a high level, Veracity speaks to the accuracy and quality aspect of the data, Value speaks to the value for the organization {11]. Big data is not a state or a thing that one can achieve but more a framework for tools and methods used with these varying data sources to deliver value from these complex and large data sources.

While combining different data sources at large volumes with varying complexity across structured and unstructured data is at the core of a BIG data project, it is easy to see how important it is to have data aligned both horizontally and vertically.

For many facilities, through the years, data has been managed differently, and an example of this might be that a simple equipment TAG is labeled differently in the different systems.

Searching for information on a specific pump becomes that much more difficult and users must navigate between asset management, drawings, and SCADA systems to find the information they are looking for. Aside from system requirements that "enforce" differences, information is often transferred in a manual way which compounds the underlying issue.

Although there is a logical inclination to look at the automation pyramid for big data applications, using the asset management systems and document management solutions can provide a trove of useful information. Utilizing process analytics, it is now possible to optimize business processes, while learning from real-world application usage and therefore 'unbottle necks' common work processes.

Finally, data is classified into two major types. Structured data, which is data stored in databases such as historians, ERP systems, document management systems, etc. Structured data is often used for reporting and analytics. And unstructured data such as documents, drawings, specifications, emails, etc. Due to their unstructured nature, it is much more difficult to gain knowledge from this type of data. It is often referenced that any given enterprise has about 80% unstructured data and about 20% structured information.

Armed with a better understanding of the kinds of data, let us review some of the quality aspects that are essential to any data set. Whether they are used for small scale integration or a big data initiative, these aspects are equally valid.

Data quality is, in simple terms, referred to as fitness for use. The most cited dimensions that define data quality are from Wand et all, [12]. Figure 4 shows a table of the most cited dimensions that describe data quality. Not all these dimensions are applicable for all data sources, but this table can serve as a good measure to assess the quality. Each of these aspects can be different for a given data source and it is up to the company to define what these levels of quality are given dimension. As a practical example, let us assume the information presented on the title block for a drawing. When referring to the completeness dimension, a company could define that a complete title block should contain the drawing number, revision, revision date, approver, reviewer, editor, and other elements of information. For the format dimension, the company could define that for each P&ID, there is at least a PDF version and an associated native (i.e., dwg) version of the document. Several standards are available that can serve as a starting point are available in this regard, for example, ISO 15926, CFIHOS, and standards from PIP.

Accuracy	Format	Comparability
Reliability	Interpretability	Conciseness
Timeliness	Content	Freedom from bias
Relevance	Efficiency	Informativeness
Completeness	Importance	Level of Details
Currency	Sufficiency	Quantitativeness
Consistency	Usableness	Scope
Flexibility	Usefulness	Understandability
Precision	Clarity	

Figure 4 - Data Quality Dimensions

What are maturity assessments?

At present, it is close to impossible to look at any business process that is not dependent on ICT in some shape or form. To what extent this process is optimized and aligned with the strategic goals is a different question and relies on a continual improvement process and assessment of the current position against internal and external goals, laws, requirements, etc. [13].

As business leaders seek these improvements, they need management instruments and methods to drive their agenda. This is where maturity models come into play; by using the model for evaluation of the current state as well as providing direction for improvements [14]. For a given business area (e.g., information quality), a maturity model allows an organization to measure itself against a given set of criteria.

Depending on the design of the model, the measurement takes the form of level descriptions; where each level provides an established list of criteria to achieve the level. Alternatively, measurements can be taken based on a Likert scale approach where a detailed question will guide the respondent in answering on a pre-defined scale. In both cases, the lower score represents an area that is less developed, where the higher scores represent well developed or optimized areas. The scoring then presents a potential roadmap for a given domain as it progresses to higher levels on the scale.

ICT Maturity models found their origins from the need to better manage software processes, during the late ’80s and 90’s when many ICT projects were over budget and excessively late whilst often not delivering what was promised. The Software Engineering Institute with support from Mitre Corp. developed a first process maturity model which later evolved into the Capability Maturity Model or CMM [15]. Figure 5 shows the different maturity stages often used in maturity models.

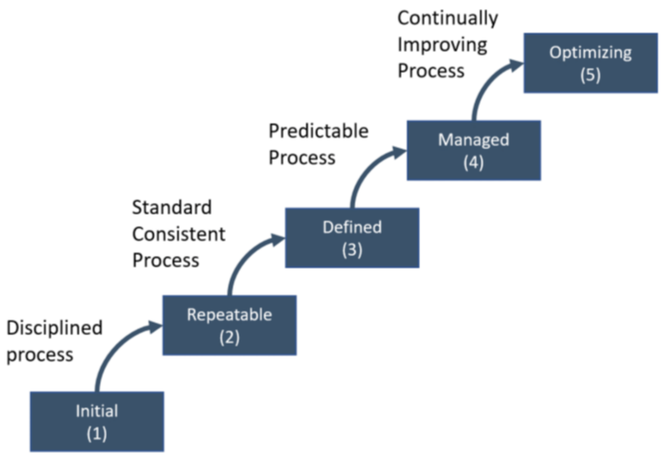


Figure 5 - Maturity stages

At present, maturity models are available for an almost unlimited number of topics. Performing a quick search on the internet will show maturity models for digital transformation, industry 4.0, project management, and almost any other topic one can think of. Although these models are widely credited for their usefulness, there is also a cautionary tale. The quality of the model and associated assessment is highly dependent on the specific application. To use a generic document management maturity model on engineering information will leave out essential elements. There are also many maturity models created that barely pass the academic stage. In selecting a model and assessment, selecting a widely used model will ensure higher accuracy and relevance to your organization.

Avoiding the endless admiration of problems.

While maturity assessments are a great management tool, it is important to define the proper scope and the expectations for what the maturity assessment project will deliver. One of the key elements in digital transformation is to experiment and fail fast. While a maturity assessment will validate and provide direction, it is key to identify practical goals that can be resolved within a foreseeable timeframe and build success. Organizations currently use the word business agility, meaning that there is a desire to address problems quickly as the business evolves in an ever-changing landscape. The purpose of an assessment is that it will provide a roadmap against which identified improvements can be executed, contributing to achievement of company goals.

With the result of an assessment available, it is now time to translate the measurement to executable goals. One methodology is to discuss the different areas of the assessment and rate areas on a priority scale, considering company goals, budgets, resources available, etc. Based on the selected areas (e.g., Deliverables management) the organization then uses the SMART goals to define the improvement project [16].

The SMART criteria are defined following:

- **S**pecific – this describes what the project will accomplish with a specific goal.
- **M**easurable – this describes how the success of the goal can be measured.
- **A**ssignable – This describes who in the organization (internally or externally) will be responsible for this goal.
- **R**ealistic – this describes why this goal is realistic
- **T**ime-related (time-bound) – this describes the timeframe for when the goal is to be completed.

SMART Goals combined with the outcome of the assessment provides management with the instruments to measure the status, but also any future progression. The defined goals provide a method to execute specific projects that will raise the level of maturity on the topic of data quality.

References

[1] P. V. Tremmel, "IBM Chief Gets Standing Ovation at Commencement," 2015. https://news.northwestern.edu/stories/2015/06/ibm-ceo-gets-standing-ovation-at-northwestern-commencement/ (accessed Jan. 06, 2021).

[2] C. Weber, J. Königsberger, L. Kassner, and B. Mitschang, "M2DDM – A Maturity Model for Data-Driven Manufacturing," Procedia CIRP, vol. 63, pp. 173–178, 2017, doi: https://doi.org/10.1016/j.procir.2017.03.309.

[3] D. Noller, F. Myren, O. Haaland, J. Brisco, and E. W. Bryan, "Improved Decision-making and Operational Efficiencies through Integrated Production Operations Solutions," 2012, doi: 10.4043/23510-ms.

[4] K. Group, "Magic of AI & Machine Learning for Engineering, Operations & Maintenance," 2020. https://www.gotostage.com/channel/b63edcc69fa247629b2ad3ece8842bd6/recording/f54e9926ecdc40d6b5a891bb22dce2b1/watch (accessed Jan. 06, 2021).

[5] A. Antonovsky, C. Pollock, and L. Straker, "System reliability as perceived by maintenance personnel on petroleum production facilities," Reliab. Eng. Syst. Saf., vol. 152, pp. 58–65, 2016, doi: 10.1016/j.ress.2016.03.002.

[6] B. S. Snitkin, B. Mick, and R. Responsibity, "The Case for Developing an AIM Strategy," 2010.

[7] M. P. Gallaher, A. C. O'Conor, J. L. Dettbarn, and L. T. Gilday, "Cost Analysis of Inadequate Interoperability in the U.S. Capital Facilities Industry," Nist, pp. 1–210, 2004, doi: 10.6028/NIST.GCR.04-867.

[8] E. O. Coetzer and P. J. Vlok, "A standardised model to quantify the financial impact of poor engineering information quality in the oil and gas industry," South African J. Ind. Eng., vol. 30, no. 4, pp. 131–142, 2019, doi: 10.7166/30-4-2080.

[9] A. G. Frank, L. S. Dalenogare, and N. F. Ayala, "Industry 4.0 technologies: Implementation patterns in manufacturing companies," Int. J. Prod. Econ., vol. 210, no. September 2018, pp. 15–26, 2019, doi: 10.1016/j.ijpe.2019.01.004.

[10] T. H. Davenport and L. Prusak, working knowledge: How organizations manage what they know. Harvard Business Press, 1998.

[11] M. S. Reis and R. Kenett, "Assessing the value of information of data-centric activities in the chemical processing industry 4.0," AIChE J., vol. 64, no. 11, pp. 3868–3881, 2018, doi: 10.1002/aic.16203.

[12] Y. Wand and R. Y. Wang, "Anchoring Data Quality Dimensions in Ontological Foundations," Commun. ACM, vol. 39, no. 11, pp. 86–95, Nov. 1996, doi: 10.1145/240455.240479.

[13] J. Becker, R. Knackstedt, and J. Pöppelbuß, "Developing Maturity Models for IT Management," Bus. Inf. Syst. Eng., vol. 1, no. 3, pp. 213–222, 2009, doi: 10.1007/s12599-009-0044-5.

[14] T. de Bruin, M. Rosemann, R. Freeze, and U. Kulkarni, "lication in the following source: Understanding the Main Phases of Developing a Maturity Assessment Model," in Maturity Assessment Model, 2005, p. 11, [Online]. Available: https://eprints.qut.edu.au/25152/.

[15] M. C. Paulk, B. Curtis, M. B. Chrissis, and C. V Weber, "Capability Maturity Model, Version 1.1," IEEE Softw., vol. 10, no. 4, pp. 18–27, 1993, doi: 10.1109/52.219617.

[16] Wikepedia, "SMART Criteria." https://en.wikipedia.org/wiki/SMART_criteria (accessed Jan. 06, 2021).

About the Author

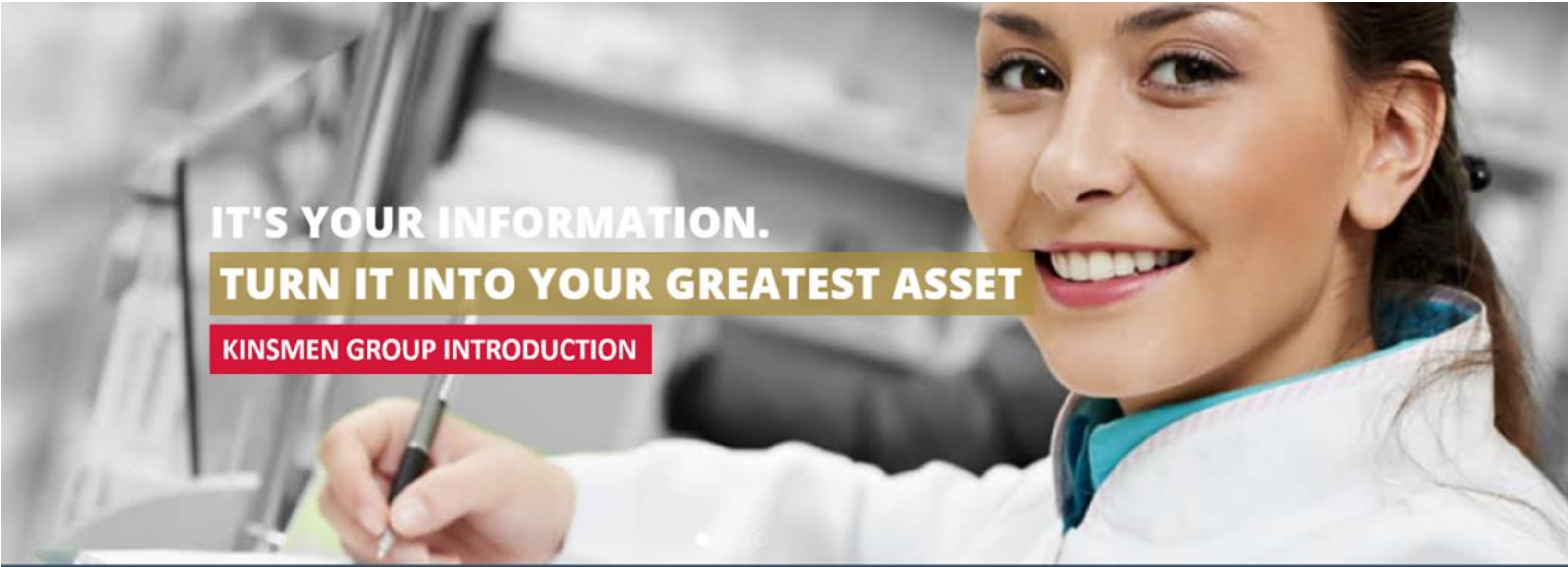
Edwin Elmendorp,

Edwin lives in Houston Texas and has close to 20 years of consulting experience for Engineering Information Management. After initially graduating as an electrical instrumentation engineer, he moved on, added a Computer Science degree, and recently graduated cum laude with a Master's in Business Process Management and IT. Aside from a solid academic background, Edwin has worked with many owner-operators to digitally transform how companies manage their information assets spanning many different software solutions

info@kinsmengroup.com

+1 713-725-0143

BEST DOCUMENTED ASSET



IT'S YOUR INFORMATION.
TURN IT INTO YOUR GREATEST ASSET

KINSMEN GROUP INTRODUCTION

WHAT WE DO

As a provider of information management software, we advise companies that design and build large assets on how to optimize their information. Whether you're in the Oil & Gas, Pharmaceuticals & Biotech, Power Generation & Utilities industry, our expertise can help you meet your company wide goals.

WHY WE DO IT

We help ensure information is accurate and easily accessible, helping you to make better decisions, cutting down on risk and getting higher returns on assets.

MERIDIAN Certified Specialist 2020

America's Fastest-Growing Private Companies Inc. 500

2020 Best-of-the-Best Professional Service Organizations

STRATEGY

Understand the maturity of your information, detail how it's managed, used, and shared. Develop a plan of action to conquer information chaos and quantify the value and ROI for optimization.

SOLUTION

Leading-edge, information management solutions to help optimize operations and maintenance, capital projects, handover, and asset acquisition information. Solution deployments, upgrades, renovations, and more.

SUCCESS

Beyond software; get unbeatable support and system administration. Training, onboarding, and change management for your people outsource document control and CAD drafting for your Capital projects.

CONTACT US TODAY

Envision your facility where all documents and data, regardless of age and source, are 100% accurate, up to date, aligned, and comply with all regulatory requirements.

info@kinsmengroup.com

+1 713-725-0143

BEST DOCUMENTED ASSET